JULY, 1957
No. 223

ASTM Bulletin

60th Annual Meeting

Materials Research and Standards Move Ahead

American Society for Testing Materials

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. . turn to page 113 for details

ASTM BULLETIN

JULY 1957

Number 223

Telephone: Rittenhouse 6-5315 Cable Address: Testing, Philadelphia

IN THE SOCIETY

GENERAL NEWS NOTES

ASTM Bulletin is indexed regularly by Engineering Index, Inc.
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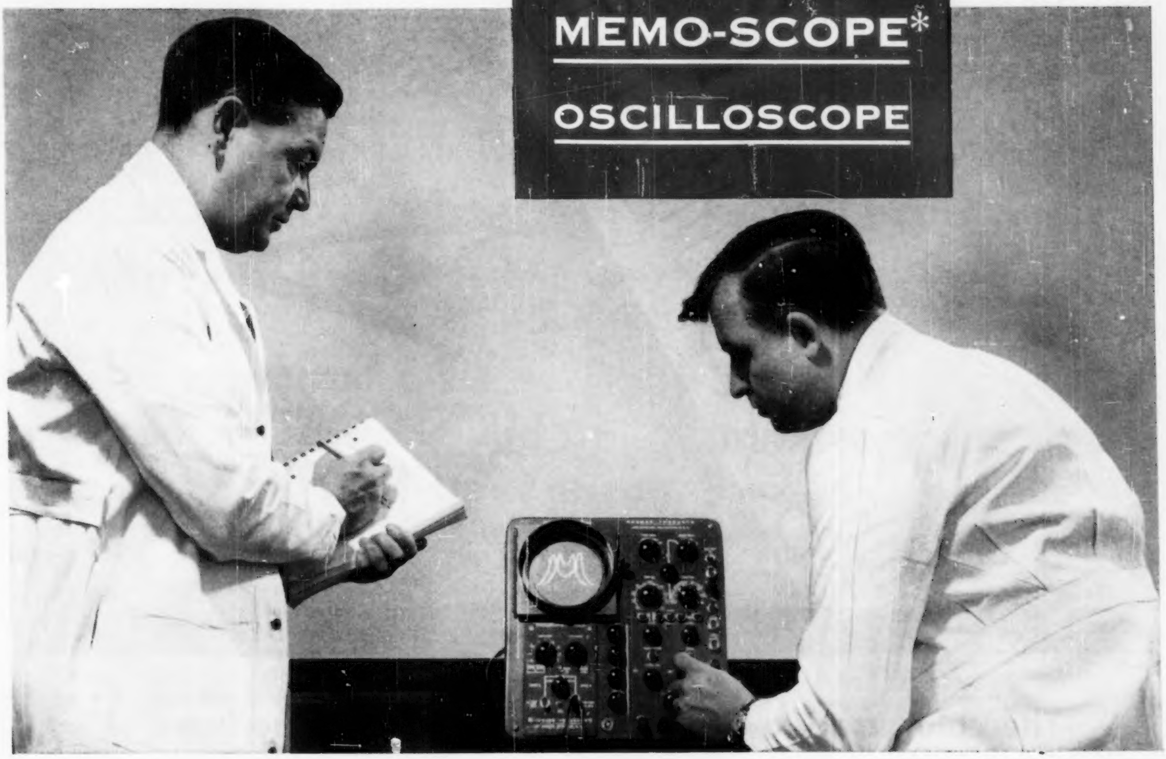

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FOR FURTHER INFORMATION CIRCLE 564 ON READER SERVICE CARD PAGE 113

Materials Research and Standards Move Ahead

Environmental Effects, Trace Element Analysis, Research Sessions and 850 Committee Meetings Provide Varied Program

THERE was something for everyone in Atlantic City this year—whether your interest is in research or standardization; in one material or a variety; in environmental effects such as nuclear radiation, high temperatures, fatigue, or moisture in concrete block; in steel, plastics, paints or rare metals; in trace elements, or statistics, it was there for you. If you had time, you could walk on the famous Boardwalk, swim in the Atlantic or even go fishing. All this and more made up the technical program and entertainment features of the 60th Annual Meeting of the Society held June 17–21 at Atlantic City.

Keynoting the symposium program were several sessions devoted to environmental effects—largely directed toward providing design data on materials for industrial applications and the defense program. Included were symposia on radiation effects, high temperatures, and fatigue testing. The famous annual memorial lectures honoring Marburg and Gillett presented by outstanding authorities covered industrial water and super-high-strength–high-temperature molybdenum alloys. Other symposia and sessions on trace element analysis, soils, masonry, concrete, and metals rounded out the technical program.

Simultaneous with the technical sessions and symposia were over 850 meetings of the Society's technical committees and subgroups each with the specific objective of keeping the ASTM standards up to date and to devise new ones in keeping with our expanding technology.

Other special events at the meeting included the Awards of Merit Luncheon, the President's Luncheon, the Ladies Entertainment Program, and the Dinner Dance.

In his address at the President's Luncheon, retiring President Dr. Rudolph A. Schatzel emphasized the Society's responsibilities and area for contribution when he said "There is a noticeable quickening of pace, a lessening in the induction period from laboratory experiment to commercial channels. This has resulted in the development of whole new industries that have a vested interest in change. In addition, we have new environments of vital importance. Among these are radiation, aerodynamic heating, high-intensity sound, broad-band shock and vibration,

At the close of the 60th Annual Meeting, Rudolph A. Schatzel (left) turned over his ASTM presidential duties to Richard T. Kropf (right) who was elected to lead the Society in the year 1957–1958. Describing ASTM as "a monument to unselfish cooperative effort," Mr. Kropf pledged his efforts to conserving the heritage from the past and to build wisely for the future.

and combinations of these. We must have reliable data and methods of evaluation of the performance of materials under these new conditions . . ."

The technical program and committee meetings highlighted in this issue show that continuing progress is being made on many of these problems.

Marburg Lecture

Water Problem is Control, not Shortage

There is no shortage of water except in specific localities. The problem is more one of collecting the water that falls as snow or rain, storing it, and transporting it to the regions where it is needed.

That is the view expressed by Everett P. Partridge, director, Hall Laboratories, Inc., in his presentation of the Edgar Marburg Lecture for 1957. Mr. Partridge emphasized the use of water as an engineering material and pointed out that industry's needs for water are largely on a loan basis—the bulk of the water used by industry is for cooling and, therefore, it is not consumed but merely borrowed and returned at a slightly higher temperature. The amount consumed corresponds to that which evaporates because the temperature is higher. Industrial water is also used for cooling by evaporation in spray towers and spray ponds. In this case the total amount of water borrowed is much less, although the volume consumed may be about the same as when the water is used for cooling without evaporation.

Dr. Partridge observed that the wastes from man's activities including the industrial uses complicate the re-use of water. The economics of eliminating or reducing these wastes discharged into the streams are extremely involved. He gave as an example a calculation based on a few parts-per-million increase in solids content of a plant effluent costing many thousands of dollars for additional water treatment required for down-stream users of the water.

Turning to the uses of water in boilers, Dr. Partridge indicated that ultra-pure water containing no more than 50 parts per billion of total impurity is specified for certain applications such as a once through boiler in which all the water entering the boiler is converted to dry steam. Corrosion in boilers is not something that is likely to be eliminated, but it can be controlled. The objective in the control of corrosion is to treat the water in such a way that a very dense coating of oxide is formed on the metal surface, thus greatly reducing the rate at which ions of iron migrate through the oxide coating to rob oxygen atoms from the water.

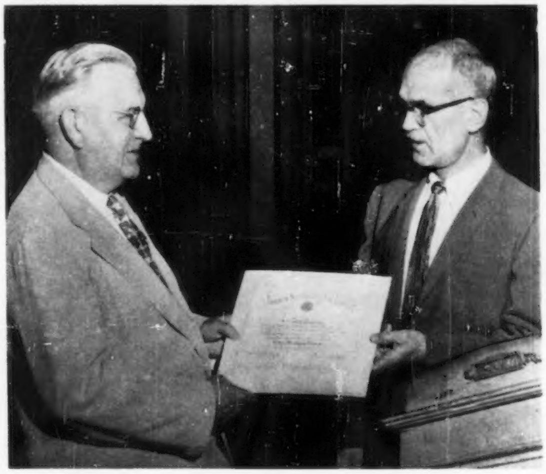
Those who heard the lecture by Dr. Partridge could not help but be convinced that water is indeed our most important raw material.

Gillett Lecture

Processing is Key to Super Hi-Temp Alloys

In an amazingly concise manner, A. J. Herzig, president, Climax Molybdenum Co. of Michigan, explained, in the 1957 Gillett Memorial Lecture, the reasons for the current great interest in the development of molybdenum-base alloys for high-temperature service.

It is important to a proper perspective of this subject to know that, at the present, only alloy additions are considered that have the least hardening effect on molybdenum rather than those which are indicated as being potential hardeners. When processes are developed to work and refine the alloys in the upper range of hardness, then entirely new information will be forthcoming. In the present state of de-



President Schatzel (left, above and below) presents their certificates to the men who gave the two honor lectures at the 60th Annual Meeting. Above: the presentation is made to E. P. Partridge who gave the Edgar Marburg Lecture which is named for the Society's first secretary. Below: the presentation to Alvin J. Herzig who delivered the H. W. Gillett Lecture which commemorates the first director of Battelle Memorial Institute and one of America's leading metallurgists.

velopment, alloys of molybdenum with titanium have been the most fully investigated, particularly the alloy containing 0.50 per cent titanium. The rupture strengths for 100-hr life of 30,000 to 35,000 psi at 2000 F and 50,000 to 55,000 psi at 1800 F for this alloy are substantially higher than the rupture strengths reported for any of the present super high-temperature materials. Scattered data on alloys containing larger additions of columbium and titanium and some ternary alloys indicate a rupture strength for 100-hr life at 2000 F of around 100,000 psi. Using this as a point of potential for molybdenum-base alloys, however, one must acknowledge that the strength potential has outrun the ability to work such metals.

Herzig described in great detail the furnace used in the laboratory of the Climax Molybdenum Co. to produce molybdenum and molybdenum-base castings weighing up to 1000 lb. The furnace combines pressing, sintering, and melting operations. The successful melting operation includes attainment of very high temperatures in an environment providing a high degree of deoxidation. About 500,000 lb of workable ingots have been produced in this furnace. It therefore appears that the major technical problem of producing castings in large section size and in substantial quantity has already been solved.

The major problems that stand between the extensive application of the new materials and the present state of their development are (1) increasing their resistance to oxidation at high temperatures, (2) development of a suitable coating to protect the metal at high-temperature service, and (3) the need for proper facilities to hot-work the metals on a laboratory test basis, leading toward the development eventually of commercial facilities.

In regard to the first and second problems, there are examples of metals which achieve oxidation resistance through the formation of thin oxide films and the possibility exists that a strong refractory alloy similarly endowed might be discovered. However, an early working solution is more likely to be obtained through coating the metal. Such coatings must have resistance to mechanical impact, resistance to hot-gas erosion, and resistance to thermal shock, in addition to the capacity for excluding oxygen.

Molybdenum-base alloys will not solve all the high-temperature problems, but they have already demonstrated that they provide the solutions to some problems. The technology within which the molybdenum-base alloys have been developed promises that the temperature range of application of metals will be greatly extended.

Soils

Engineering Properties of Soils

In the Session on Soils, several widely diversified papers on soil as an engineered material were presented. The first paper discussed an interesting problem in soil testing solved by simple and efficient apparatus only recently introduced to this country. W. J. Eden and J. J. Hamilton pointed out in their paper "The Use of a Field Vane Apparatus in Sensitive Clay," that they had obtained reliable shear-strength data on extremely sensitive deposits of marine clay in the St. Lawrence River lowlands.

Previous to the use of this vane apparatus, obtaining adequate undisturbed samples for reliable data presented major difficulties. The authors consider that the vane data are more reliable than the data from conventional laboratory tests, because the vane tests are conducted *in situ*. Wide variations known to occur in laboratory strength determinations, point up serious limitations of the laboratory procedures.

The vane apparatus described in this paper was designed to be used in conjunction with standard soil sampling equipment and is portable so as to be used with hand-operated auguring equipment in areas where heavy equipment access is not feasible.

A paper on the "Design and Deflection Control of Buried Steel Pipe Supporting Earth Loads and Live Loads," was presented by R. E. Barnard, one of the pioneers in this field. He reviewed the theoretical aspects of loading on buried pipe and tunnels and considered practical problems and their solutions.

Under certain conditions, pipe can support loads far above its maximum strength. To accomplish this, pipe must yield to the point where the soil itself becomes part of the supporting mechanism. Barnard compared calculated deflections with measured deflections for various cases and gave examples and solutions for various types of soil problems.

W. E. Schmid, prior to the presentation of his paper on "The Permeability of Soils and the Concept of a Stationary Boundary-Layer," analyzed the results of many experimental studies and noted significant discrepancies with accepted theoretical equations on the permeability of soils. In an effort to correlate these test results with a mathematical expression of these phenomena, the author chose the Hagen-Poiseulle equation as most closely related to the permeation problem. Mr. Schmid presented data to show that he had systematically investigated and developed the factors which influence the movement of a fluid through a porous medium. The resulting investigation shows that the fundamental concept of the stationary boundary-layer is in excellent agreement between the theory of viscous flow and experimental results on the permeability of granular media.

Steel

Novel Tear Test for Sheet Metal

The Charpy impact test can be used to evaluate the high-rate tearing properties of sheet metal according to S. V. Arnold, Watertown Arsenal, in a paper presented at the Session on Steel. The unique feature of the test consisted of riveting many sheets together to obtain a workable size sample. It was demonstrated that the rivets did not materially affect the results since comparable data were obtained with two- and four-rivet laminates.

"The Effect of Phosphorus on the Susceptibility to Temper Embrittlement of Cast Cr-Mo-V Steel" by J. Chaberek and R. F. Zeno of General Electric Co., presented data which may serve as the basis of revision of ASTM standards covering steels used at high temperatures.

A few years ago deoxidized bessemer steel was included in ASTM specification A 53 for welded and seamless steel

September 1—Last Day for Annual Meeting Papers Discussion

Written discussion of papers and reports presented at the Annual Meeting will be received by the Committee on Papers and Publications until September 1. In view of the fact that much of the discussion published in the *Proceedings* is submitted after the meeting by letter, it will be helpful if all who can will send in their discussion to Headquarters well in advance of this date so that additional time is available to review and refer the discussion to authors for closure.

Gathered at the head table at the President's Luncheon to honor retiring President R. A. Schatzel were, left to right: R. E. Hess, ASTM Associate Executive Secretary; Past President Truman Fuller; Past President H. L. Maxwell; E. J. Albert, retiring national Director and chairman of the Annual Meeting Dinner Committee; Frank L. LaQue, newly elected Vice-President; K. B. Woods, Senior Vice-President; President Schatzel; Past-President N. L. Mochel, toastmaster at the luncheon; J. F. Thompson, 50-Year ASTM Member (Dr. Thompson responded for the 50-year Members and his remarks on this occasion will be found on page 17); Richard

pipe. In an effort to supply data to evaluate the use of this steel, compared to that manufactured by the open-hearth process, A. B. Wilder and W. P. Benter, National Tube Division, U. S. Steel Corp., presented a paper on "Behavior of Open Hearth and Bessemer Seamless Steel Pipe." The paper presenting "The Static Properties of Several High-Strength Steels" by E. P. Klier, B. B. Murdi, and G. Sachs of Syracuse University, contributed a large amount of much-needed data on materials used in light-weight constructions, particularly with regard to their notch sensitivity.

Large Fatigue Machines

Fatigue Tests Scaled up—Size Effect Significant

To date most of our knowledge of fatigue of materials has come from tests on relatively small specimens that bear little resemblance to the part being designed. But the seven papers comprising the Symposium on Large Fatigue Machines and Their Results point up a current trend to carry out fatigue tests on actual components.

In arranging this symposium, J. M. Lessells, of Lessells & Associates, Inc., obtained representation from the aircraft, electrical, marine, railroad, and earth removal industries. Several new types of large fatigue testing machines were described.

Full-Scale Tests

In a paper entitled, "Torsional Fatigue Testing of Axle Shafts," E. J. Eckart, of Caterpiller Tractor Co., described a fatigue testing machine that tests shafts in torsion up to 4 in. in diameter. The machine is a hydraulic, nonrotating, constant-load device capable of loading a specimen in both directions. It was constructed for conducting unidirectional torsional tests on axle shafts used in earthmoving machines. Eckart highlighted his talk with a film showing the machine in operation. The mechanical features, specimen, and actual loading cycle were vividly illustrated. Test results showed the machine to have dependability and good reproducibility.

H. V. Cordiano, of N. Y. Naval Shipyard, described a constant-load repeated bending fatigue machine constructed for conducting full scale fatigue tests on welded and riveted joints. The machine operates on the principle of the dynamic vibration absorber. Results obtained were shown to be generally in agreement with the work reported by other investigators.

Size Effect

While the development of large machines to conduct full scale tests solved certain problems, it also raised others, notably the existence of a size effect on the fatigue strength of plain specimens. Furthermore, such effects as stress-concentration and fretting corrosion of large-size sections may have a different relation to the basic strength than they have in small-size sections.

F. C. Eaton in a paper on "Fatigue Tests of Large Alloy Steel Shafts," showed a size effect in cyclic bending which supports the previous work of O. J. Horger. Eaton found a considerably lower fatigue limit for the large diameter unnotched shafts than that obtained on small diameter specimens. On the other hand, T. W. Bunyan, Lloyd's Register of Shipping, in a paper on marine shafting showed no size effect in cyclic torsion. Eckart, in comparing his results with those in the published literature, found the fatigue strength of large specimens to be somewhat less than that of smaller specimens.

An additional contribution to our knowledge of fatigue was the data of O. J. Horger and H. R. Neifert on fretting corrosion of large shafts. They showed that chromium plating applied to press-fitted members tended successfully to suppress the effects of fretting corrosion and increase the fatigue life of such members.

The papers and discussions in this symposium make available valuable data on the effect of size. But the question of why cycle bending appears to indicate a size effect not shown in cyclic torsion tests will need to be explained in future work. It has been pointed out that there are theoretical grounds for believing that both modes

T. Kropf, incoming President; Alvin J. Herzig, the Gillett Lecturer; Past President L. C. Beard who retired from the board after many years of service; D. E. Parsons, also retiring from the Board; Past-President J. G. Morrow; and Executive Secretary R. J. Painter who presented a summary of the Board Report. For more news about incoming President Kropf and Vice-President LaQue and the five newly elected Directors, please turn to page 10.

of stressing should show a decrease in fatigue strength as the size of the cross-section is increased.

The experimental difficulties connected with the fatigue testing of large specimens are considerable, and the tests are expensive and time consuming. In this light, the material presented in this symposium will greatly enhance the literature.

Fatigue

Fatigue Cracks Seen up Close

A long look into microscopic fatigue cracks indicates that structures should be designed on the basis of theoretical stress. That was the conclusion of a paper on "Cracking in Notch Fatigue Specimens" by M. S. Hunter and W. G. Fricke of the Aluminum Company of America in the Session on Fatigue.

The authors observed at high magnifications the surface initiation and propagation of fatigue cracks in the vicinity of notches. Quantitative measurements were recorded in an attempt to discover the operative mechanisms.

All of the observations were made on 6061-T6 aluminum alloy tested in R. R. Moore rotating-beam machines. The fatigue testing was interrupted periodically and plastic replicas made of the specimen surface. These cellulose acetate replicas faithfully reproduced surface details that could be examined under the microscope at high magnifications. By comparing the series of replicas of the specimen under test, it was possible to observe the formation of all fatigue cracks at the notch root and to follow their surface propagation around the specimen.

The authors presented data to show that the theoretical stress obtained at notches is a good, though conservative, measure of the stress controlling fatigue-crack initiation and the early stages of crack propagation. They also pointed out that there is a remaining problem of determining whether these findings hold true for other alloys.

Concrete

Papers on Concrete Advance Knowledge of Properties and Performance

A wide variety of important contributions to the knowledge of concrete were made at two sessions devoted to this important construction material.

A study of the effects on freezing-and-thawing resistance on concrete, presented by H. L. Flack, U. S. Bureau of Reclamation, showed that the methods of curing specimens and the methods of conducting the tests introduced wide variations in the results. However, despite the wide variations in tests, all methods evaluated the different concretes in the same relative order.

A method of impulse testing of reinforced-concrete beams promises to provide useful data to designers of buildings and structures to resist blast forces similar to those resulting from high explosive or atomic bombs. The test including instrumentation and method of spring-loading two beams simultaneously was described by F. T. Mavis, Carnegie Inst. of Technology, and J. J. Greaves, Arthur G. McKee Co.

A study of the performance of truck mixers reported by A. G. Timms, Worthington Corp., revealed that for rated $4\frac{1}{2}$-cu-yd mixers, a minimum of 50 revolutions of the drum was sufficient to produce the desired uniformity in concrete except for certain slurry and split loading conditions. The slump tests indicated that a paving type concrete of low slump can be readily produced in truck mixers with good uniformity.

A report on the first evidence of alkali-aggregate reaction in Canada and a situation where the reactive aggregate was undetected by current ASTM tests was presented in two papers by E. G. Swenson, National Research Council of Canada. A study of a concrete bridge deck which had expanded abnormally over a period of 25 years disclosed serious deterioration due to reactive

(Continued on page 12)

New Officers

President

Richard T. Kropf, in his capacity of vice-president and director of research for Belding Heminway Co., Inc. (a position he has held since 1949) directs the activities of the Industrial Thread Division and serves as vice-president and general manager of Belding Corticelli Industries, Inc. He has been associated with his company since graduation from Massachusetts Institute of Technology in 1931, in various positions in Michigan, Connecticut, and finally New York City. During this period of research activity, he worked extensively on natural and synthetic fiber yarn and thread, mechanical applications of textiles, and development and design of sewing threads and yarns for specific mechanical and chemical applications. His responsibilities in Belding Corticelli Industries, Inc., the chemical manufacturing subsidiary of Belding Heminway Co., include the direction of research, and manufacturing and marketing of the company's products which include special polymers such as nylon and related products.

The new ASTM President has been an active member of the Society since 1944, concentrating in the Textile Committee where he has served as First Vice-Chairman and as Chairman of the Papers Subcommittee. He is currently a member of the Advisory Committee and several working groups.

Mr. Kropf also lends his support to numerous other organizations and governmental agencies such as ACS, American Physical Society, Fiber Society (of which he is a past president) New York Academy of Science, trustee of the Textile Research Institute, American Association of Textile Technologists, and as scientific consultant to the Quartermaster General.

Vice-President

Frank L. LaQue is vice-president of the International Nickel Co. and manager of its Development and Research Division since 1954. Canadian-born, he joined the company in 1927, the year he was graduated from Ontario's Queen's University with a B.S. degree in chemical and metallurgical engineering, and has since that time concentrated on problems of corrosion. Under his direction the well-known corrosion testing stations at Kure Beach and Harbor Island, N. C., were established. His eminence in this field was recognized by ASTM in 1951 when he was asked to give the Edgar Marburg Lecture on "Corrosion Testing." This is one of many articles and papers he has written on corrosion.

Mr. LaQue, who has been a director of the Society since 1955, became a member in 1935 and is currently a member of the Administrative Committee on Papers and Publications and several technical committees.

His other activities include the ACS, AAAS, NACE, (past president) and service on the Visiting Committees of Massachusetts Institute of Technology and Case Institute of Technology. The NACE honored him in 1949 with the F. N. Speller Award.

Directors 1957–1960

Claude L. Clark, metallurgical engineer in special steel developments, has been associated with the Timken Roller Bearing Co. since 1940. A native of Saginaw, Mich., Dr. Clark took his undergraduate degrees as well as his Ph.D. at the University of Michigan. In his years as a research engineer and lecturer in metallurgical engineering in the University's Department of Engineering Research, he developed one of the first low-alloy steels for high-temperature service, known commercially as DM steel, and a widely used stress-rupture test. He has also developed a series of alloy steels for commercial and aircraft applications.

Dr. Clark's membership in ASTM dates from 1929 in which time he has served actively on the steel and alloy steel committees and the Joint ASME-ASTM Committee on Effect of Temperature on the Properties of Metals. He represents the Society on ASA Sectional Committee B36 and was appointed last year to the ASTM Special Administrative Committee on Nuclear Problems. He also holds membership in ASM, ASME, AIME, and NACE, including the ASME Boiler Code and High-Temperature Steam Generating Committees.

Dr. Clark has written over 100 papers, a book, *High Temperature Alloys,* and holds several patents.

Arthur E. Juve has been in the employ of the B. F. Goodrich Co. ever since receiving his bachelor of chemical engineering degree from Ohio State University in 1925. Until 1942 he was engaged in compounding and development work on industrial products, and since that time has been in the Goodrich Research Division. He is at present director of technical service research at the B. F. Goodrich Research Center in Brecksville, Ohio.

For many years Mr. Juve has been connected with ASTM Committee D-11 on Rubber and Rubber-Like Materials and is currently chairman of Subcommittee XXIX on Compounding Ingredients. He has also been active in the Division of Rubber Chemistry of the American Chemical Society and served as its chairman last year.

Mr. Juve has had many technical papers published in the field of rubber technology and he is the author of a chapter on "Physical Testing" for the monograph *Synthetic Rubber*, edited by G. S. Whitby.

John H. Koenig has been the director of the School of Ceramics and the New Jersey Ceramic Research Station at Rutgers University for twelve years. A registered ceramic engineer, he has served as consultant to the Research and Development Board of the Department of Defense from 1947–1953 and is the author of many technical papers in his field.

He was educated at Ohio State University where he earned his degree in chemical engineering in 1931. Following a short period of research with General Electric Co. he returned to Ohio State for his doctor's degree as a Fellow at the Engineering Experiment Station. Another period in industry followed as research engineer with the Hall China Co., and in wartime he served in the Navy Bureau of Ships.

As Rutgers School of Ceramics' official representative in ASTM, Dr. Koenig has been active in Committees on Manufactured Masonry Units, Ceramic Whitewares, (past chairman) and Porcelain Enamel.

He is also a Fellow of the American Ceramic Society, a member of the National Institute of Ceramic Engineers, American Society for Engineering Education, and the National Ceramic Education Council.

Rudolph Earl Peterson has spent most of his professional career with Westinghouse Electric Corp. and is presently manager of the Mechanics Department of the Research Laboratories in Pittsburgh.

A native of Illinois, Mr. Peterson received his degree in mechanical engineering at the University of Illinois in 1925 and his master's degree in theoretical and applied mechanics in 1926 at the same university. The following year, after a short period as designer at the Burd Piston Ring Co., he joined Westinghouse and moved up to his present position in 1931. Mr. Peterson has specialized in the theory of gearing, strength and fatigue of materials, relation of materials testing to design, and analysis of fractures, and has written about 45 papers on these subjects.

Mr. Peterson's 28 years of active service as a member of the Society were recognized in 1954 when he received an ASTM Award of Merit. He has been Chairman of ASTM Committee E-9 on Fatigue since its organization in 1946 and is also vice-chairman of the Administrative Committee on Simulated Service Testing.

In addition to ASTM, Mr. Peterson is a past president of the Society for Experimental Stress Analysis and was formerly chairman of the Advisory Board of *Applied Mechanics Reviews* and is now chairman of the Applied Mechanics Division of ASME, and chairman of ASA Committee Z10.3 Mechanics Symbols.

Russell Wade Seniff, manager of research for the Baltimore & Ohio Railroad, has been in the railroad industry since his graduation from Illinois Wesleyan University in 1924. He was first with the Alton Railroad in Bloomington, Ill. and upon its merger with the Gulf, Mobile, & Ohio in 1946, continued in his work as engineer of tests until he was appointed to the same position with the Baltimore & Ohio, assuming his present position in 1953.

Mr. Seniff's early railroad work was in the field of water treatment for power boilers and boiler maintenance and metallurgical problems. Later work pertained to research, design, construction, operation, tests, and inspection. He has done research work in diesels since 1935. During World War II he was a consultant on boiler maintenance and water treatment to the U. S. Army.

As the ASTM representative of the B & O membership, Mr. Seniff has been active in ASTM technical work for many years. He is a member of the Cast Iron and Petroleum Committees and has served on the Washington District Council for four years. He is also a member of the Association of American Railroads, American Railway Engineering Assn., ASME, SAE, (vice-president in 1951) and the Coordinating Research Council.

Seated at the head table at the 60th Annual Meeting Awards Luncheon were, left to right: ASTM Assistant Secretary Fred F. Van Atta; newly elected Director R. W. Seniff; Past-President Arno C. Fieldner; Everett P. Partridge, Marburg Lecturer; Past-President L. J. Markwardt; Past President John R. Townsend; President Schatzel; Richard T. Kropf, incoming president; Myron A. Swayze,

Sessions

(*Continued from page 9*)

aggregate. The second paper discussed an unusual case of cement-aggregate reaction for which standard tests were not effective criteria.

A comprehensive paper on design and writing of specifications for quality control of concrete was presented by E. A. Abdun-Nur, consulting engineer, and L. H. Tuthill, California State Department of Water Resources. The importance of ASTM standards for reference was emphasized by the authors, citing a large engineering project involving reference to some 250 ASTM standards.

While the strength of insulating concretes may be considered to be of secondary importance, it is recognized as an excellent index of general concrete quality. In the paper on "Insulating Concrete and Compressive Strength" by Morton Sherman, Zonolite Co., the author indicates that the usual factors in the testing of concrete, such as the height-width ratio of test specimens and rate of application of load are not critical in insulating concrete when kept within reasonable limits. On the other hand the extent of moist curing, curing temperature, moisture content at time of test, and oven-dry density, can all seriously affect the magnitude of measured compressive strength.

A prepared discussion on this paper by S. B. Helms, Lehigh Portland Cement Co., presented considerable test data on insulating concrete using cubes and prisms principally, rather than small cylinders.

Flexural strength of concrete is influenced by many factors not readily controlled. With the increasing use of modulus of rupture as a basis for the design and acceptance of concrete, the authors of the paper on "Flexural Strength Testing of Concrete," Stanton Walker and D. L. Bloem, National Sand and Gravel Assn., conducted a comprehensive investigation on the reliability of the flexural strength test. The paper presented at the session represented the third of three parts of the report on this work, and discussed the effects of variations in testing procedures. The authors found the measurement of flexural strength to be highly sensitive to variations in treatment and testing of specimens. It was the conclusion that entirely satisfactory control can be secured by establishing the relationship between flexural and compressive strength from laboratory tests with the materials to be used and thereafter using compression tests as the basis for acceptance. There was discussion presented which expanded on this conclusion.

The rate of hardening of concrete is an important factor on some construction jobs where close control and time schedules are required. The rate of hardening is affected by variations in concreting materials, mix proportions, admixtures, air content, consistency and storage temperature. By means of stainless steel pins embedded vertically in a concrete specimen, the authors, T. M. Kelly and D. E. Bryant, The Master Builders Co., have developed a means of measuring bond strengths at successive time intervals after the concrete mixture has been placed. In the discussion of this paper it was pointed out that the bond pull-out pin method, as well as the method using the Proctor needle on mortar wet-screened from the concrete, provided excellent means of determining the rate of hardening of concrete. These methods are particularly useful in the laboratory but can also be used as field tests.

Concrete surfaces in industrial plants are subjected to large wheel pressures which make it imperative that the concrete be capable of withstanding many abrasive forces with a minimum of wear. The development of methods of test to determine the wear resistance of concrete has been under consideration for a number of years. James L. Sawyer, Lone Star Cement Research Laboratories, presented a paper describing a German standard method of test and machine which has been adopted as a national standard in that country. The author conducted tests with the German machine using a slightly modified test method. It was the conclusion of the author that the test procedure subjects the test specimen to wear due to forces that are similar to those experienced by a floor surface in service. It was found that adequate curing has an important effect on the wear resistance, that surface moisture increased the wear, and that a definite relationship exists between the compressive strength and wear resistance.

chairman, Award of Merit Committee; Past-President Arthur W. Carpenter; R. E. Peterson, newly elected Director; Past-President H. H. Morgan; Past-President H. J. Ball; and Executive Secretary R. J. Painter. Honored at this luncheon were the winners of the ASTM Awards of Merit (see page 14); the winners of the Dudley Medal and various other Society and Technical Committee honors (page 18); and the ASTM 40-Year Members (page 23).

Gases in Metals

The precise determination of gases in metals has become increasingly important, particularly in steel, in nickel and other materials for electronics uses and in titanium. Methods for determining hydrogen, nitrogen, and oxygen in electronic nickel have recently been published as tentative by the Society. Information on current advances in methods for determining gases in metals was presented in five papers in the symposium on this subject.

The methods described included vacuum fusion, bromination-carbon reduction, and emission spectrochemical techniques, with three of the papers dealing with vacuum fusion. While the determination of a number of gases was covered, three of the papers were devoted specifically to the determination of oxygen by the three techniques previously mentioned.

Several types of vacuum fusion apparatus were described in detail. Most of these were described as being applicable to the determination of a number of gases in a variety of metals. An apparatus designed specifically for the determination of hydrogen in steel also was described in detail. A variety of fusion bath materials and their effects on results were covered.

Although the vacuum fusion technique appeared to be the more versatile, the paper covering the emission spectrochemical method for oxygen pointed out definite advantages in greater speed than the other techniques.

Sampling is a major factor in the accuracy of any chemical analysis. This was shown to be particularly important in determining gases in metals because of segregation in the material being sampled and changes in sample after it was taken. Sample history was shown to have a very significant effect on the interpretation of results.

Spectrochemical Analysis for Traces

Analyzing for the Infinitesimal

The versatility of emission spectrochemical analysis is well known. This is especially true in the determination of trace elements, where spectrochemical methods often make possible satisfactorily precise simultaneous determinations of several elements in considerably less time than such extremely small amounts can be determined by other means.

In the Symposium on Spectrochemical Analysis for Trace Elements, it was necessary to recognize at the outset that what is considered a trace in one field is much more than a trace in another. In some metallurgical fields as much as 1000 parts per million may be considered a trace, while in the case of certain semiconductors a trace element may be present in the order of 1 part per billion.

The various spectrochemical techniques suitable for the determination of trace elements in a variety of materials were considered, ranging from metals, ceramics, and like inorganic materials to plant and animal tissues and fluids, including even such complex things as metal-enzymes. Spectrochemical analyses were shown even to be highly useful in agriculture by providing means for evaluating correlation between plant composition and soil conditions. The techniques included direct determinations on the solid sample, on samples in solution, and on powdered samples. Also covered were indirect techniques employing preliminary chemical separation and concentration by a variety of means such as electrolysis, emf reduction, precipitation, ion exchange, and liquid-liquid extraction. One paper described a technique found capable of determining traces of impurities in semiconductors in the order of 1 part per million by means of graphite spark excitation after preliminary chemical separation and concentration.

The factors limiting the smallest traces that can be quantitatively determined by spectrochemical analysis were discussed. Among them are the absolute sensitivity of the element being determined and the matrix in which the element occurs.

Non-Ferrous Metals

Cemented Carbides Show Elastic and Plastic Behavior

Rhenium metal, beryllium copper, cemented carbides, and aluminum alloys, certainly represent a range from one of the new metals to a metal which is produced commercially in substantial tonnage. Yet the fact that all of these were the subject of technical papers in one session is an indication of the intense interest being shown by American industry in investigating every possible

(*Continued on page 19*)

Awards of Merit

J. W. Bolton D. L. Colwell A. G. H. Dietz

Twelve technical leaders in the field of engineering materials—men who have rendered outstanding service to the American Society for Testing Materials, especially in its technical committee work—were honored at the Awards Luncheon of the 60th Annual Meeting with Awards of Merit.

Under the rules governing the Award of Merit, each technical committee may suggest one candidate annually, and the Award Committee may select nominees from other areas of the Society's work as well. While each of the men listed below was honored for intensive work and contributions in a specific technology, each has furthered in numerous ways the general activities of the Society.

To **John Ward Bolton** *(retired) director of metallurgical research and testing, The Lunkenheimer Co., Cincinnati, in recognition of constructive, longtime efforts and leadership in the work of several technical committees, especially A-3 on Cast Iron, and for contributions in other areas, both administrative and technical.*

Mr. Bolton is a native of Terre Haute, Ind. He was graduated from Rose Polytechnic Institute and, following various industrial positions, joined Lunkenheimer in 1927.

He became a member of ASTM in 1922 and a member of Committee A-3 on Cast Iron in 1937 being active on five subcommittees and serving as chairman of the main committee from 1940 to 1944. In addition to his service on A-3, Mr. Bolton served on Committees A-1 on Steel, B-5 on Copper and Copper Alloys, and the Joint ASTM-ASME Committee on the Effect of Temperature on the Properties of Metals.

Mr. Bolton helped to organize the Ohio Valley District of ASTM, serving as Chairman *pro tem* and council member from 1949 to 1954. He served on the Advisory Committee on Research, 1945 to 1950, and was a member of the Board of Directors for three years starting in 1951. He is the author of the book, *Gray Cast Iron* and fifty other technical papers, and in 1939 he was the American Foundrymen's Assn. Penton Gold Medalist.

To **Donald Lewis Colwell,** *director of laboratories, Apex Smelting Co., Cleveland, in recognition of sustained and valued contributions in various standardization and research programs, especially in Committee B-6 on Die-Cast Metals and Alloys, and for other longtime service including district activities.*

Mr. Colwell was born and educated in Chicago, receiving his B.S. degree from the University of Chicago. He was associated as metallurgist and subsequently sales manager for the Stewart Die Casting Division of Stewart Warner Corp.; and was at one time sales engineer for Paragon Die Casting Co.

During World War II he spent two years with the War Production Board directing conservation of non-ferrous metals and three years as coordinator of conservation for the Navy Dept. He received the Distinguished Civilian Service Award from the U. S. Navy for the latter service, and was the recipient of the Certificate of Appreciation from the U. S. Air Force for serving with the United States Strategic Bombing Survey in Japan at the close of the war.

His service with the Apex Smelting Co. as sales engineer and later director of laboratories, has covered twelve years.

A member of ASTM since 1927, Mr. Colwell has been active in Committee B-6 on Die-Cast Metals and Alloys, having been first chairman of its Subcommittee II. He is past chairman of Committee B-7, currently its Vice-Chairman, and also holds offices on several subcommittees. He was chairman of the Chicago District Council and is now a member of the Cleveland District Council.

Mr. Colwell is the author of many technical articles on die castings and aluminum casting alloys.

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To **Albert George Henry Dietz,** *professor of building engineering and construction, Massachusetts Institute of Technology, Cambridge, Mass., in recognition of constructive leadership in the work of Committee C-19 on Structural Sandwich Constructions, and for notable contributions in Committee D-20 on Plastics, and to other ASTM activities.*

Mr. Dietz is a native of Lorain, Ohio. He was educated at Miami University, receiving his B.A. degree in 1930; and at Massachusetts Institute of Technology, receiving his Doctor of Science degree in 1941.

He joined the staff of MIT's Department of Building Engineering and Construction in 1934, becoming Professor in 1950. He has had leaves of absence to the Forest Products Laboratory as senior engineer; and to the Office of Field Service of the Office of Scientific Research and Development as field service consultant. He has been director of the Plastics Research Laboratory, Impact Program, and Adhesives Laboratory of MIT and is a member of the Solar Energy Committee there.

As a member of ASTM, Dr. Dietz has been active on Committees C-19 on Structural Sandwich Construction, D-20 on Plastics, and Committee D-14 on Adhesives. In 1948 he was one of the joint recipients of the Richard L. Templin Award.

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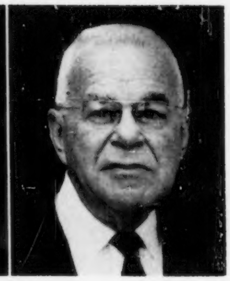
To **Theodore Parker Dresser, Jr.,** *chief engineer and vice-president, Abbot A. Hanks, Inc., San Francisco, in recognition of longtime valued service*





T. P. Dresser P. V. Faragher E. W Fasig

in advancing the interests of ASTM on the West Coast, especially through Northern California District activities, and for support of technical and administrative work.

Mr. Dresser, a native of Medford, Mass., studied mining engineering at the University of California. He was appointed to his present position as chief engineer in 1917, and has been continuously connected with inspection, testing, research, and consulting in the field of materials and related construction problems. The work under his direction has included concrete and earth dams, concrete and steel structures, foundation investigations, soil mechanics, metallurgical investigations, corrosion problems, and specifications writing, in addition to general investigational services.

He has been the representative of the firm in ASTM since 1917, is a former member of the Board of Directors of the Society, of the Administrative Committee on District Activities, and of Committee D-18 on Soils for Engineering Purposes; is a member of Committee C-1 on Cement and has been active in the affairs of the Northern California District Council since its organization in 1930.

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To **Paul V. Faragher** *(retired) Metallurgical Division, Aluminum Company of America, Pittsburgh, in recognition of longtime respected leadership and significant contributions to the activities of Committees B-1 on Wires for Electrical Conductors, and B-7 on Light Metals and Alloys, Cast and Wrought, and other technical groups.*

Mr. Faragher is a native of Sabetha, Kan. He received his B.A. degree from the University of Kansas in 1909, and the degree of Ph.D. from Massachusetts Institute of Technology in 1913. He was a member of the faculty of the Department of Chemistry of the University of Kansas from 1913 to 1918 with the rank of assistant professor and associate professor. In 1919 he held an industrial fellowship at Mellon Institute, and at the end of the year was employed by the Aluminum Company of America where he assumed responsibility for the specifications for Alcoa's products. He continued in the Metallurgical Division until retirement in July of 1956.

His association with ASTM committees began in 1922 although his personal membership dates from 1929. He has served as secretary of Committee B-6 on Die-Cast Metals; Chairman of Subcommittee III of B-7 on Light Metals; Chairman of Subcommittee VII of B-1 on Wires for Electrical Conductors; and is Chairman of Committee E-8 on Nomenclature and Definitions. He is also a member of the Society's Ordnance Advisory Committee.

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To **Edgar W. Fasig,** *vice-president, manufacturing and technical development, The Lowe Brothers Co., Dayton, in recognition of constructive contributions over many years to ASTM research and standards work, especially as a longtime officer of Committee D-1 on Paint, Varnish and Lacquer, and for administrative support.*

Mr. Fasig, is a native of Allen County, Ohio, and was educated at Ohio State University where he received his B.A. degree in 1918.

Except for service in the Army during World War I, Mr. Fasig has been with The Lowe Brothers Co. since 1917. His first position was that of laboratory chemist from which he became research chemist in 1918, assistant general superintendent in 1920, general superintendent and technical director in 1926, and Vice-President of Manufacturing and Technical Development in 1956.

Mr. Fasig has been active in ASTM for many years. He is a member of Committee D-1 on Paint, Varnish, Lacquer and Related Products; the Technical Coordinating Committee of the Paint Industry, representing the Scientific Section of the National Paint, Varnish and Lacquer Assn.; has served on the Administrative Committee on Papers and Publications; and was a member of the Ohio Valley District Council.

Co-author of the "Paint and Varnish Production Manual," he received the George B. Heckel Award of Paint Industry Magazine in 1955 for his contributions to the paint industry.





W. H. Koch R. E. Penrod F. W. Reinhart F. G. Tatnall W. C. Voss

To **William Arthur Kennedy** *(deceased) supervisor of products, The Grinnell Co., Inc., Providence, R. I., in recognition of outstanding service and valued contributions, especially supporting standardization and research work in Committee A-7 on Malleable-Iron Castings, and marked leadership in this group where he served as Chairman for eleven years.*

Mr. Kennedy, at the time of his death a few days after having been selected to receive the ASTM Award of Merit, was supervisor of products, The Grinnell Co., Inc., Providence, R. I.

A native of Providence, he was educated at Brown University, receiving the Ph.D. degree in 1906 and B.S. in mechanical engineering in 1907. After a few years as instructor in mechanics and mechanical drawing, he became testing engineer for the General Fire Extinguisher Co. (Grinnell Co., Inc.), serving from 1910 until 1921, when he became supervisor of products.

Mr. Kennedy had been a member of ASTM since 1941 and had served on several of the Society's technical committees, including A-7 on Malleable Iron Castings, A-3 on Cast Iron, B-8 on Electrodeposited Metallic Coatings, and E-1 on Methods of Testing. He served as Chairman of Committee A-7 from 1956 until his death this spring.

J. H. Lansing, Secretary of ASTM Committee A-7, who was closely associated with Mr. Kennedy in his ASTM activities, accepted the award for him.

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To **Wilmer H. Koch,** *works chemist, Niagara Operations, Olin Mathieson Chemical Corp., in recognition of longtime service and important contributions to the major accomplishments of Committee D-12 on Soaps and Other Detergents, including vigorous leadership of the group concerned with inorganic alkaline detergents.*

Mr. Koch, a native of Bethlehem, Pa., was graduated from Lehigh University with a B.S. degree in chemistry.

Since 1920, he has been associated with the Mathieson Alkali Works at Niagara Falls which company has since become the Niagara Operations of the Olin Mathieson Chemical Corp. Prior to this, he was employed by the New Jersey Zinc Co. (of Pa.), Palmerton, Pa.; Electric Steel and Metals Co., Welland, Ontario; and E. I. du Pont de Nemours & Co., Inc., at Lodi, N. J.

Mr. Koch has been a member of ASTM since 1932 and has been very active in the work of Committee D-12 on Soaps and Other Detergents, having been Chairman of its subcommittee on Analysis of Inorganic Alkaline Detergents and a member of the D-12 Advisory Committee; Chairman of the Publications Committee of D-12 and for the past two years Vice-Chairman of D-12. He is also a liaison member of D-12 with Committee E-2 on Emission Spectroscopy.

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To **R. E. Penrod** *(retired), chief metallurgist, Bethlehem Steel Co., Johnstown, Pa., in recognition of outstanding cooperation and notable technical contributions to Committee E-4 on Metallography, especially in solving problems in the important field of metal grain size determinations.*

At the time of his retirement in September 1955, Mr. Penrod had served Bethlehem Steel Co. and its predecessors in Johnstown, Pa., for 53 years, all in the same department.

His original service started in 1902, in the Metallurgical Department of Cambria Steel Co. After filling various positions in this department, he was promoted to assistant chief metallurgist in 1917 and to chief metallurgist in September, 1928, which position he held until retirement.

Over the years Mr. Penrod has been an active member of ASTM and presently is serving on the following committees: A-1 on Steel, E-4 on Metallography (Vice-Chairman), and on E-4 Subcommittees VIII on Grain Size (Chairman) and I on Selection and Preparation of Samples, II on Definitions, and IX on Inclusions.

It was under the leadership of Mr. Penrod that Method E 112-55T for Estimating the Average Grain Size of Metals was finally established after many years of effort.

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To **Frank Walter Reinhart,** *chief, Plastics Section, National Bureau of Standards, Washington, D. C., in recognition of productive service of broad scope in ASTM technical work, strong leadership, including committee chairmanships, and outstanding contributions to the Society through research and standards covering especially plastics and adhesives.*

Mr. Reinhart, chief of the Plastics Section of the National Bureau of Standards, Washington, D. C., directs the Bureau's research and development and testing program on plastics, plastic coatings, and adhesives.

A native of Pennsylvania, Mr. Reinhart received his B.S. degree summa cum laude from Juniata College in 1930 and has taken postgraduate courses at Columbia University and the University of Maryland. He taught chemistry at Juniata College from 1930 until he joined the NBS staff in 1937.

Mr. Reinhart first became active in ASTM committee work in 1945 as a representative of the NBS and became an individual member in 1947. He is Chairman of Committee D-20 on Plastics, and Past Chairman of D-14 on Adhesives.

He is co-author and author of some 30 technical papers on plastics and received the Superior Accomplishment Award of the Department of Commerce in 1946 and the Meritorious Service Award in 1957.

To **Francis G. Tatnall,** *vice-president and general manager, Tatnall Measuring Systems Co., Phoenixville, Pa., in recognition of intense activity in many phases of ASTM work including district, membership promotion, and technical development, especially notable in Committee E-1 on Methods of Testing.*

A native of Pittsburgh, Pa., Mr. Tatnall was educated at the University of Pennsylvania, receiving his B.S. in mechanical engineering in 1920 and his graduate degree in mechanical engineering in 1925.

In association with A. H. Emery and A. C. Tate, he founded the Emery-Tatnall Co. for the development and manufacture of hydraulic testing machines, which became associated with Baldwin-Southwark Corp. Mr. Tatnall then became manager of the Testing Machine Dept., Baldwin-Southwark Div. of the Baldwin Locomotive Works and manager of Testing Research of the Baldwin-Lima-Hamilton Corp. from 1943 to 1956.

His activities in ASTM have been many: Past Chairman, Philadelphia District Council; formerly a Director; presently Special Adviser-Member of Subcommittees 2 on Speed in Mechanical Testing and 3 on Elastic Strength of Materials of Committee E-1 on Methods of Testing; A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys member of C-19 on Structural Sandwich, D-20 on Plastics, D-9 on Electrical Insulating Materials and D-18 on Soils.

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To **Walter Charles Voss,** *professor emeritus and lecturer, Dept. of Building Engineering and Construction, Massachusetts Institute of Technology, Cambridge, Mass., in recognition of loyal, longtime support of ASTM research and standards work, including both administrative and technical aspects, especially in ASTM Committee C-7 on Lime, which he headed for ten years.*

Professor Voss was born in Chicago and received his B.S. degree in architectural engineering from the University of Illinois and his M.S. degree from MIT.

In 1914 he was appointed head of the Department of Architectural Construction at Wentworth Inst. in Boston, a position he held until 1926 when he accepted the post of district structural engineer for the Boston office of the Portland Cement Assn. He joined the MIT staff of the Department of Building Engineering and Construction in 1928 and became head of the Department in 1940. He has been a consultant in architectural construction and materials since 1919, and is a licensed architect, master builder, and registered engineer.

Professor Voss has rendered services too numerous to mention to various local and state government agencies. In ASTM he has been Chairman of Committee C-7 on Lime (currently Vice-Chairman) and of the Administrative Committee on Research in 1948.

50-Year Members

At the President's Luncheon grateful recognition was given the following individuals and companies who, through membership in the Society, have supported its work for half a century:

Herbert Abraham, president, Ruberoid Co.
Henry C. Boynton, consultant
John F. Thompson, chairman, International Nickel Co.
Morton O. Withey, dean of engineering, University of Wisconsin (retired)
Reading Co.
Rensselaer Polytechnic Institute
Youngstown Sheet and Tube Co.

Dr. Thompson made the response for the group. His comments upon looking back on the Society fifty years ago when he became a member follow:

Fifty-year members from left to right are: E. B. Plott representing Youngstown Sheet and Tube; J. F. Thompson; President Schatzel; L. H. Schiefele representing Reading Co.; E. J. Kilcawley, representing Rensselaer Polytechnic Inst.

"The desired result at the lowest possible cost"

J. F. Thompson cites Society's Role in promulgating specifications which meet the need but do not burden the producer with unnecessary requirements:

In considering a suitable subject to which to refer in acknowledging the recognition of the 50-year members, I thought of discussing the society itself, its growth from a rather small beginning to its present outstanding position in the technical world, to review the number of specifications fifty years ago in comparison to those of today and also to discuss the widening number of applications which are now subject to specification and which in those early days were in an embryonic stage or perhaps not even known at all. However, my inquiry into the condition of the society fifty years ago started an entirely new trend of thought.

I have been associated with monel metal during all of this period. An example of the condition of specifying at that early date concerns one of our largest industrial companies, which was also our largest individual purchaser of monel metal and who had a very simple specification. On each order was marked, "refer to J. F. Thompson." I was supposed to be in such close contact with their work that I knew as well as they what properties they wished to have and, more essentially, what properties they had to have. It was my responsibility to see that the deliveries which the nickel company made to them were usable and, as far as possible, possessed properties sufficiently above that level to open further vistas in a very important engineering development.

While this was a simple and perhaps rather naive method of specification, it was very efficacious. The producer knew as well as the consumer—and to the same degree as the consumer—what was necessary. The producer was also informed as to the horizons toward which the consumer was working and was able to direct all of his efforts toward assisting him to reach these horizons. Of equal importance also was the fact that the producer knew what were the unessential properties and was able therefore to proceed without being hampered by a number of unimportant details. Because it must be recognized that *while a specification is made up essentially of details, the importance of these details differs from use to use.* In an aside, one might say that probably of necessity, points of specification are apt to creep in, which while essential to some users, are completely negligible for others.

This reminds me of a story one of my friends told me in regard to his first experience in the metallurgical department of one of the big steel companies. About the second day he was there, he was handed a long and complicated specification for some steel plate and told to go down and discuss with the plate mill roller the steps necessary to meet these specifications. I am afraid that his experience at that time had been more theoretical than practical so he took the specification, went down to the mill, and started to read it over with the roller. He had read only a comparatively few words when the roller interrupted him and said, "Wait, don't read any more. Tell me just one thing—how bad can I make it?" I think in that question there lies a great point, an important point, concerning specifications.

One of the most important functions of all of us engaged in the engineering profession or in engineering businesses is to accomplish a desired result at the lowest possible cost. Those of us who have been in the producing end of the business have always had to struggle against the unnecessary specification which is put on to an order often without realizing the large, unnecessary expense with which it is burdening this order. As a result, many specified materials are produced at excessive expense to meet a requirement which has grown into habit without having any engineering validity at the time regardless of the validity which it perhaps possessed in the past.

In this activity the American Society for Testing Materials has played an important role. It is made up of men from both the producing and the consuming industry and it has over the years forged a set of specifications, recognizing at the same time the absolute necessity of assuring that people purchasing material under these specifications can be assured of products of a grade which can be utilized to fulfill the purposes for which they are intended and also, specifications which do not burden the producer with unnecessary requirements.

During our fifty years we have seen this society fulfill this function in a way which has made it outstanding among technical societies. The three companies and the four individuals celebrating their fiftieth anniversary today have seen and been part of this. On behalf of all of them I can say we are greatly honored at your action today.

Medals and Awards

CHARLES B. DUDLEY MEDAL

This medal, established by voluntary subscriptions from the members, is a means of stimulating research in materials and of recognizing meritorious contributions to its publications, at the same time commemorating the first President of the Society, whose inspiring leadership has had a profound influence on its development.

● 1957 award to **R. U. Blaser** and **J. J. Owens** for their paper "Special Corrosion Study of Carbon and Low-Alloy Steels."

R. U. Blaser, assistant superintendent, Materials Div., Babcock & Wilcox Co., Alliance, Ohio, was graduated from the University of Akron with a B.S. in physics and has been with his company continuously since 1937, his work including heat transfer, fluid flow, and development work for power plant equipment. He has written a number of other papers including several presented before the ASTM.

J. J. Owens, Thompson Products, Inc., Cleveland, Ohio, with Babcock & Wilcox when the award-winning paper was written, worked there for eight years on problems associated with the development of nuclear power, becoming head of the Nuclear Engineering Section. He is a registered professional engineer in Ohio.

R. U. Blaser J. J. Owens

RICHARD L. TEMPLIN AWARD

The purpose of this award is to stimulate research in the development of testing methods and apparatus, to encourage the presentation to the Society of papers describing new and useful testing procedures and apparatus, and to recognize meritorious efforts of this kind.

● 1957 award to **Walter Ramberg** and **L. K. Irwin** for their paper "Longitudinal Impact Tests on Long Bars with a Slingshot Machine."

Walter Ramberg, physicist, National Bureau of Standards, is a 1926 graduate of Cornell University, and received his doctor's degree from the Technical University of Munich. Since 1931 he has been in the Mechanics Div. of NBS working on determination of mechanical properties of structural materials and with strength, stability, and vibration of structural elements under static and dynamic loads. He is an active member of ASTM.

L. K. Irwin, mechanical engineer, National Bureau of Standards, has been with the Bureau since 1949 when he was graduated from the University of Alabama. His work has dealt with investigations in dynamic properties of materials, experimental stress analysis, and mechanical test methods. He has been an active member of the Society for several years.

Walter Ramberg L. K. Irwin

SAM TOUR AWARD

The purpose of this award is to encourage research on the improvements and evaluation of corrosion testing methods and to stimulate the preparation of technical papers in this field.

● 1957 award to **K. G. Compton** and **A. Mendizza** for their paper "Galvanic Couple Corrosion Studies by Means of the Threaded Bolt and Nut Wire Test."

K. G. Compton, a research electrochemist with Bell Telephone Laboratories Inc., for 28 years, has worked on storage batteries, electrolytic condensers, corrosion, electroplating, paint, adhesives, wood preservation, and electrical devices. He has been an active member of ASTM for many years and is currently Chairman of the Advisory Committee on Corrosion and of B-3 on the Corrosion of Non-Ferrous Metals.

A. Mendizza, a graduate of Columbia University, has been with Bell Telephone Laboratories for 29 years, concerned chiefly with general corrosion problems and the engineering of metallic finishes for telephone plant. He has written several papers in his field and is a member of ASTM technical committees.

K. G. Compton A. Mendizza

FRANK E. RICHART AWARD

The purpose of this award, commemorating an Honorary Member of the Society is to encourage research and standardization, and to recognize notable contributions in the field of concrete and concrete aggregates.

● 1957 award to **Stanton Walker.**

Stanton Walker has been director of engineering with the National Sand and Gravel Assn. since 1926 and has held the same position with the National Ready Mixed Concrete Assn. since 1930. He is also a director of the NSGA Research Foundation and of the NRMCA Research Laboratory. He has been a member of ASTM since 1920 and very active in its work in technical committees and on the Board of Directors. Mr. Walker is also a past president of the American Concrete Institute and past chairman of the Highway Research Board.

Stanton Walker

MAX HECHT AWARD

This award, in honor of the first chairman of Committee D-19 on Industrial Water is presented to a member of that committee in recognition of outstanding service to the committee in the advancement of its objective—the study of water as an engineering material.

● 1957 award to **R. C. Adams.**

R. C. Adams, an engineering graduate of the University of Michigan, held several positions in industry prior to joining the U. S. Naval Engineering Experiment Station where he has been chemical engineer since 1953. He has been very active in ASTM since taking out membership in 1946. He has served on several technical committees in addition to Committee D-19, was chairman of the Editorial Com-

mittee responsible for the *Manual on Industrial Water*, and fulfilled a term on the Society's Administrative Committee on Papers and Publications.

R. C. Adams

SANFORD E. THOMPSON AWARD

This award was established by Committee C-9 on Concrete and Concrete Aggregates to commemorate its first chairman, to be given to the authors of papers of outstanding merit in that field, to stimulate research and extension of knowledge, and to recognize meritorious efforts.

● 1957 award to **T. C. Powers** for his outstanding work in the field of concrete and concrete aggregates.

T. C. Powers, manager of basic research section of the Portland Cement Assn. since 1940, was graduated from Willamette University. He has been a member of the Society for several years and has written numerous papers on concrete research. He is a three-time winner of the Wason Research Medal of the American Concrete Institute—in 1932, 1945, and 1948.

T. C. Powers

Sessions

(*Continued from page 13*)

source, for properties demanded by present industrial applications.

C. T. Sims of Battelle Memorial Institute described tests for measuring electrical resistivity and thermoelectric potential of rhenium and gave the test results. This investigation by G. B. Gaines and C. T. Sims was undertaken with a view toward developing thermocouples with rhenium as one of the metals, to measure very high temperatures. The work indicates that rhenium-tungsten and rhenium-molybdenum junctions show promise for use as thermocouples up to 2600 C in neutral or reducing atmospheres.

The fact that variations in mechanical and physical properties with test direction would affect the design and performance of heat-treated beryllium copper prompted J. T. Richards of Penn Precision Products to institute a research project on this matter. In this paper, co-authored with Kiyoshi Murakawa of the Institute of Science and Technology in Tokyo, it is shown that cold rolling, solution treating, and precipitation hardening do cause certain directional characteristics.

Contrary to common belief, cemented carbides exhibit elastic and plastic behavior. This was shown in a paper by R. P. Felgar and J. D. Lubahn of the General Electric Co. Three grades of Carboloy were investigated by tension, compression, and torsion tests with measurements of modulus of elasticity, Poisson's ratio, proportional limit, yield strength, strain hardening exponent, ductility, and fracture strength. The discussion was enlivened by S. L. Hoyt, Battelle Memorial Inst, who reminisced on the tests used to evaluate Carboloy when it first developed.

W. L. Fink, Alcoa Research Laboratories, described the standardization of ultrasonic testing procedures and instruments for inspection of aluminum alloys. Acceptance standards for fatigue life were shown to depend on a zoning principle that requires very rigid requirements for extremely small critical regions where high stress concentrations exist and where the plane of the discontinuity lies perpendicular to the direction of loading.

High Temperature

Thermal Shock Problems? Use Wrought or Cobalt-Base Alloys

A new thermal shock testing apparatus and procedure simulating gas-turbine service conditions was described by E. E. Reynolds, of Allegheny Ludlum Steel Corp., in a paper entitled "Thermal Shock Resistance of High-Temperature Alloys." This was one of nine papers on high temperature presented at the Annual Meeting.

In this paper written by F. L. Muscatell, E. E. Reynolds, W. W. Drykacz, and J. H. Dalheim, all of Allegheny Ludlum, results were presented for a number of heat-resisting superalloys and stainless steels. The data showed the effects of test conditions and material variables. Wrought alloys were found to be more resistant to thermal shock than cast alloys, and cobalt-base alloys were more resistant than either nickel- or iron-base alloys.

Test specimen failures produced on this thermal shock testing apparatus were similar to those occurring in service, and service parts tested in the apparatus failed in a manner similar to the test specimen. The authors also described the effects on thermal shock life of alloy composition and condition, grain size, test temperature, surface condition, melting procedure, and boron addition to cast alloys.

Previous work in the field of thermal shock resistance or thermal fatigue of alloys has been limited. Most of the information available is based on arbitrary conditions of heating, cooling, and sample design selected to give reasonable failure times of samples. The present work fills a need in providing test methods simulating service conditions and in evaluating various superalloys and stainless steels.

Not too long ago, the effect of elevated temperature on the strength properties of metals was not a matter of wide interest. Today this is one of industry's greatest concerns, with most of the attention being focussed on such areas as high-speed aircraft, missiles, turbines, nuclear applications, and a host of processes in the chemical industry.

REGISTRATION—ANNUAL MEETINGS.

	Year	Members	Committee Members	Visitors	Total	Ladies
Atlantic City	1949	1092	530	235	1857	335
Atlantic City	1950	1160	637	334	2131	408
Atlantic City	1951	1220	660	402	2282	393
New York	1952	1375	674	557	2606	280
Atlantic City	1953	1290	786	394	2470	445
Chicago	1954	1223	700	306	2224	178
Atlantic City	1955	1341	862	323	2537	234
Atlantic City	1956	1497	887	512	2896	204
Atlantic City	1957	1628	935	369	2932	140

Further research data on this problem of thermal behavior were given in eight additional papers presented during the two high-temperature sessions. Some of the subjects covered included compressive creep, micro-hardness measurement, notch geometry, long-time exposure tests, and the creep properties of tungsten rod, ductile irons, and killed carbon steel.

Design engineers concerned with modern power plants, such as the aircraft gas turbine, are ever confronted with the problem of how to cope with rapid repeated temperature changes on metals. Engineering data in such fields as mechanical and physical properties are generally adequate so that practical application of materials can be assured. But in the field of thermal shock, design data have been meager. The material presented in these papers on high temperature should go a long way in bridging the gap and in encouraging future work along these lines.

Abstracts of most of the papers were given in the April issue of the BULLETIN.

Radiation Effects on Materials

More Data Needed for Economic Nuclear Power

Material for nuclear power plants must be chosen on a basis of conservative estimates and tests according to W. L. Fleischmann, Knolls Atomic Power Laboratory, General Electric Co., in a paper presented at the Annual Meeting. Speaking on considerations affecting selection of structural materials for components of nuclear power plants, Mr. Fleischmann pointed out that there is only a very short history of construction and operation with nuclear power plants from which to get the experience necessary for design as compared to conventional power plants. Although recently some definite trends in reactor design have been established and the first plants of whatever type have given satisfactory performance, Fleischmann stated that much more knowledge of the effect of nuclear radiations on matter is needed. The adoption of general standards at present would be premature, because with increasing knowledge of the effect of environmental conditions, better and surely less expensive materials will be applied.

Mr. Fleischmann's paper was one of a symposium on Radiation Effects on Materials sponsored jointly by the Atomic Industrial Forum and ASTM Committee E-10 on Radioisotopes and Radiation Effects. M. J. Feldman and R. H. Fillnow, Westinghouse Atomic Power Division, discussed the problems of standardization of techniques in radiation studies. The application of the Battelle research reactor to radiation-effects studies was described by J. W. Chastain, Jr., Battelle Memorial Inst.

C. L. Boyd, General Electric Co., Hanford Laboratories, discussed the examination and testing techniques at the HAPO Radio-Metallurgical Laboratory. The effects of radiation on semiconductor devices was described by M. A. Xavier in a paper by the speaker and S. Nelson, A. Yefsky, A. Walters, and G. J. Rotariu of Cook Electric Co.

The authors reported on a study being made of many commercially available semiconductor devices. Other papers presented covered the Effect of Heat Treatment and Burnup on the Radiation Stability of Uranium-10 without Molybdenum Fuel Alloys by G. D. Calkins, J. E. Gates, and F. A. Rough, Battelle Memorial Inst, and D. O. Leeser, and A. DelGrosso, Atomic Power Development Associates; Engineering Effects of Radiation on Nuclear Fuels by B. Lustman, Westinghouse Atomic Power Division; A Survey of the Radiation Stability of Hydrocarbon Fuels by J. B. Carroll, R. O. Bolt, and J. A. Bert, California Research Corp.; and the Selection of Organic Materials as Reactor Coolant-Moderators, by E. L. Colichman and H. R. J. Gercke, Atomics International, Division of North American Aviation, Inc.

Dissolved Oxygen in Water

The determination of dissolved oxygen in industrial water has been the subject of intensive study for many years, not only in the ASTM Committee D-19 on Industrial Water but in a number of other organizations. The methods currently published under the ASTM Designation D 888 – 49 T have been the subject of cooperative test programs since their last revision in 1949—yet work to evaluate the present test methods and to seek even better methods continues as vigorously as ever.

In 1955 a week-long series of cooperative tests was conducted, under the sponsorship of the Dissolved Oxygen Subsection of Committee D-19, at a large electric power station. At the Symposium on Dissolved Oxygen in Water, K. G. Stoffer presented a detailed discussion of the test program, special preparation and apparatus, test conditions, statistical analysis of the test results, and conclusions as to the relative accuracy of the methods now parts of Methods D 888. One important conclusion from the test program was that there is need for a more positive method of standardizing and controlling the amounts of dissolved oxygen in such a study before any positive decisions can be made concerning the relative accuracy of the various test methods.

Polarographic measurement of dissolved oxygen was proposed as an additional method having some special advantages, in the paper by W. W. Eckenfelder and Conrad Burris. The polarographic method appears to be particularly suitable for use where the water contains appreciable amounts of organic matter, as in the case of biological sludges and certain other industrial wastes. It is not suitable in the presence of gaseous or volatile constituents having a lower oxidation potential than molecular oxygen; for example, free halogens. Details affecting the polarographic measurement of oxygen were discussed, including the effects of supporting electrolytes, temperature, and variations in apparatus.

Continuous measurement of the dissolved oxygen content of a flowing sample of water by means of the Beckman Dissolved Oxygen Analyzer was discussed in the paper by Thomas Finnegan and Ross C. Tucker. In this apparatus, dissolved oxygen is determined from the relationship between the conductivity of the water sample before and after the addition of nitric oxide. Sensitivity to changes in oxygen concentration of a few parts per billion is credited to this apparatus.

The Hartmann and Braun dissolved oxygen apparatus, described in the paper by A. J. Ristaino and A. A. Dominick, measures and records continuously the dissolved oxygen content as indicated by the electric current generated by the action of the dissolved oxygen on a voltaic cell. Results are very close to those obtained by the ASTM referee method.

Also used for the continuous measurement of dissolved oxygen in water is the Cambridge Analyzer, covered in the paper by H. A. Grabowski. This apparatus depends upon the measurement of the thermal conductivity of gases or gas mixtures. Excellent agreement with results obtained by the ASTM referee method is credited to this apparatus also.

Masonry

Methods of Reducing Wall Cracks and Mortar Disintegration

Among the many factors contributing to cracks in masonry walls are temperature shrinkage, carbonation shrinkage, and moisture shrinkage. Only the latter can be controlled significantly. These and other observations relating to masonry construction were made during the session on Masonry on June 21.

Carl A. Menzel, Portland Cement Assn., in a paper, "Fallacies in the Current Per Cent of Total Absorption Method for Determining and Limiting the Moisture Content of Concrete Block," presented data indicating that the moisture held by air-dry concrete at equilibrium with a given relative humidity is influenced by many factors and is not significantly related to the total absorbed water in a saturated block. On the basis of the data shown, he urged that the current per cent of total absorption method be replaced as soon as possible by the relative humidity method, which he claimed provides a reliable indication in about 20 to 60 minutes of the state of dryness and potentialities for dry shrinkage. The time consumed is less than 2 per cent of the 48 to 72 hr required by the per cent of total absorption method.

In discussion, R. E. Copeland, National Concrete Masonry Assn, argued that while the relative humidity method has considerable merit it requires further evaluation over a broader range of conditions before being adopted by the Society. He maintained that the total absorption method is not as bad as depicted and that, while the relative humidity method is quicker, it is not always as fast a test as indicated by the author.

A second paper entitled "Measuring Shrinkage of Concrete Block" by E. L. Saxer and H. T. Toennies, Research Foundation, University of Toledo, and National Concrete Masonry Assn, Chicago, respectively, compared test methods. Data were shown on the results of shrinkage measurements by three different methods: the modified British method, the rapid method, and a reference method. The authors' data showed that results from the modified British method compared to the reference method were much more consistent than were those of the rapid method compared to the reference method.

Data shown in discussion by S. B. Helms, Lehigh Portland Cement Co., showed somewhat different results.

The third paper of the Session on Masonry presented a survey of "Recent Disintegration of Mortar in Brick Walls." C. C. Connor, consultant, and W. E. Okerson, New Jersey Bell Telephone Co., reported on an investigation covering 64 buildings in which the brickwork was subject to many variables in workmanship, materials, and construction practices. Fifty-one of the 64 buildings studied had some degree of mortar disintegration and 13 had none, a ratio of about 4 to 1. Although some of the conclusions were necessarily tentative because of limitations of the data, it was indicated that disintegration of mortar joints is progressive with time; it generally took about two years after construction for mortar disintegration to appear; the evident cause of mortar disintegration was efflorescent salts forming at or near the surface of the mortar joints; sodium and potassium sulfates were the main components of the efflorescent salts and the evidence indicated that cements with more than 0.6 per cent of the sodium and potassium oxides (soda equivalent) were consistently associated with mortar disintegration.

YOUR HOSTS . . .

At the 60th Annual Meeting were the capable men of the Philadelphia District who have had so much to do this year as in past years with the success of Annual Meeting arrangements.

Chairman of the District is Tinius Olsen 2nd, Tinius Olsen Testing Machine Co.; dinner chairman was E. J. Albert, chairman, Thwing-Albert Instrument Co.; entertainment for the dinner-dance was managed by E. K. Spring, Pencoyd Steel and Forge Corp.; chairman of the ladies' entertainment program was H. W. Stuart, U. S. Pipe and Foundry Co.

Round-Table

Statistical Aspects of ASTM Standards

A feature of unusual interest at the Annual Meeting was a round-table discussion covering interlaboratory testing, selecting the more sensitive test method and a review of the program of Committee E-11 on Quality Control. The program which was sponsored by Committee E-11 to provide an opportunity for committee members to discuss mutual problems in this field featured papers on the above subjects by several members of the committee to spark the discussions.

Grant Wernimont of Eastman Kodak Co. and Paul Olmstead of Bell Telephone Laboratories made a joint presentation on interlaboratory tests. Mr. Wernimont explained that the committee had about completed development of an interlaboratory test plan which could be used by all ASTM committees as a guide in setting up interlaboratory test programs. He warned, however, that such a broad plan as this cannot be applicable to all possible situations. He indicated that most people in interlaboratory testing are interested in a statement of the precision of the test, precision of the laboratory, and precision of the method. In the analysis of test results he indicated that the analysis of variance might be supplemented on many occasions by the use of non-parametric methods including control charts, the analysis of runs, order statistics and sign tests.

Concurring generally with these remarks, Olmstead pointed out some of the problems in the use of analysis of variance. Often some accident happens during the test, or one laboratory or several are out of line in test results. Interlaboratory tests must therefore be set up, both to track down significant differences and to provide a statement of precision of the method if applicable.

During the discussion which followed there was strong support for the use of analysis of variance to derive as much information as possible from the data; others apparently were satisfied by more direct attack on lesser but still important problems. All participants stressed the need for writing the proposed standard on interlaboratory testing for the engineer and not for the statistician.

John Mandel of the National Bureau of Standards showed how to select the more sensitive of the two alternate test methods to describe a known or unknown quality of a material. He cautioned that the two methods must be correlated, otherwise they might not be measuring the same thing. His remarks are elaborated in the NBS *Journal of Research*, Vol. 52, No. 3, 1954, under the title "Sensitivity—A Criterion for the Comparison of Two Methods of Test."

Oliver Beckwith's paper reviewed the program of Committee E-11. This program, which is quite comprehensive, is designed to aid and advise all of the technical committees of the Society on the application of quality control methods to standardization and to provide manuals, recommended practices, and the like, on matters relating to statistics and quality control. A more complete review of the committee's program is planned for a forthcoming issue of the Bulletin.

Technical Committees

New Applications Pose New Demands on Materials—Spark Activity in Over 850 Committee Meetings

Materials are often considered academically on a basis of properties and their molecular and atomic structure. While this type of discussion does go on in ASTM committee meetings, what makes engineering materials come to life is their interaction with other materials and effects of environmental conditions in applications. Thus, in the many meeting rooms and corridors of the Chalfonte-Haddon Hall, Seaside, and Traymore Hotels in Atlantic City, during the week of the 60th Annual Meeting, much of the talk was on environmental effects and applications. Nuclear radiation, high temperatures, and physical and electrical stresses of all kinds were much in evidence in the discussions. New and improved metals, alloys, ceramics and chemical products are needed for application in many new developments in industry, the national defense program, and the highway program. The problems of testing materials and specifying their properties are accentuated by these new demands.

Not only do new environments and new applications influence the committees' work but also constantly increasing knowledge of materials makes it necessary for committees to take a new look at old tests and old specifications. This also occupied much of the time of the committees at this meeting.

Following are a few of the highlights of some of the many committee meetings in Atlantic City this year.

Metals . . .

Steel in the nuclear energy program was the subject of a special session at the June 26 meeting of **Committee A-1 on Steel.** N. L. Mochel, manager of metallurgical engineering, Lester Station of the Westinghouse Electric Corp., presented data on the predicted future of electric power generated from nuclear fuel which caused many a listener to sit forward in his seat. Most of those present were quite aware of the extensive use of ASTM specifications in construction of power plants developing electricity from conventional fuels. The use of these same materials in nuclear power plants will be much discussed at future Committee A-1 meetings.

Dr. P. K. Conn of ANP Div., General Electric Co., presented data on the effect of nuclear radiation on some of the steels manufactured in accordance with ASTM specifications. Dr. Conn was speaking as a representative of Committee E-10 on Radioisotopes and Radiation Effects which offered to give such typical data to any ASTM committee dealing with materials now being used or proposed to be used in the nuclear energy field.

The chairman of the Committee on Specifications of the American Institute of Steel Construction had requested an opinion as to whether it would be practical in the basic structural steel Specification A-7 to raise the specified minimum yield point from the present 33,000 psi. The official reply will be that it is impractical to raise the present yield strength with the present limitations on tensile strength, elongation, and bend tests; and further, that weldability, ductility and notch toughness might be adversely affected by such a change.

There are several important and controversial standards dealing with steel products used in concrete reinforcement being considered by the committee. One covers uncoated seven-wire stress-relieved strand for prestressed concrete, and the other, hot-rolled plain rods in coils for concrete reinforcement.

The new steel making process using an oxygen lance (known as the LD process in Europe) has become established in this country. Several steel producers have asked that steel made by this process be permitted with the present open hearth and basic bessemer processes in several of the ASTM specifications for steel pipe (A 53 and A 120). Now that the terminology "basic oxygen process" has been established to cover the LD as well as related processes, the path appears clear to cover steel pipe in ASTM specifications made by this process.

A project on arriving at an ASTM specification for centrifugally cast ferritic alloy-steel pipe for high-temperature service is well under way. The task group has held several meetings and many comments are to be incorporated into another draft of the specification. With the increasing availability of such products, this specification should be a worth-while addition to the present ASTM specifications for tubular products intended for high-temperature service.

- Once again a new use for an old metal has sparked development of a new specification. In its last stages of development within **Committee A-2 on Wrought Iron** is a specification for electric fusion (arc)-welded wrought iron plate pipe. In 1955, (for the first time since 1937) this same committee approved a new tentative specification for a wrought iron product (heat exchanger and condenser tubes). It appears that wrought iron continues to hold its rightful place in industrial applications.
- For the past year, **Committee A-5 on Corrosion of Iron and Steel** has been studying the use of magnetic gages to measure the thickness of metallic coatings. This procedure has shown such excellent reproducibility and accuracy that this type of measurement may replace others presently in use. The current program evaluating methods of testing aluminum coatings on steel was reviewed and a new specification on flat steel armoring tape was discussed at the meeting.

New Approach on Magnetic Tests

D. C. Dieterly, vice-chairman of **Committee A-6 on Magnetic Properties** reported progress on a complete revision of Methods of Test for Alternating-Current Core Loss and Permeability of Magnetic Materials (A 343 – 54), representing two and a half years of intensive effort. He pointed

out that an entirely new approach has been taken to formulate methods which will be more understandable to the inexperienced users and more complete in detail of procedure where this seems essential for adequate performance. Instead of drafting the method for one size of specimen, one standard test frame, one frequency, and one or two standard test inductions, the committee has attempted the more difficult job of writing a test method applicable to several choices of frequencies and test inductions. Two basic methods are employed: (1), a voltmeter-ammeter-wattmeter method for core loss and exciting current at inductions of 10 kilogausses and upwards at low frequencies and (2) a a bridge method for effective a-c permeability and core loss primarily at inductions of 10 kilogausses and lower over a wide range of frequencies. Both methods use short Epstein strips lap joints in the 25-cm Epstein frame. Together the two methods cover the range of test inductions and properties of interest in most conventional applications.

The revised methods have been carefully evaluated in interlaboratory tests, and committee approval is expected within the year.

Ferrites

In recent years an important new area of nonmetallic magnetic materials has become commercially important—the ferrites. A new activity on nonmetallic magnetic materials was established recently in Committee C-21 on Ceramic Whitewares and Related Products. The relationship of this new group with Committee A-6 was discussed, and considerable interest was expressed in providing active liaison between the two committees.

● Quite an interest has been evident in **Committee A-9 on Ferro-Alloys** in developing specifications for silicomanganese, ferrocolumbium, and ferrocolumbium-tantalum. It has been decided to promote specifications for silicomanganese and ferrocolumbium. Because of the frequent variation in the tantalum-columbium ratio of ferrocolumbium-tantalum no specification for this product will be established at this time.

Temperature Effects

The power industry will directly benefit from a new project assumed by the Steam-Power Panel of the **ASTM-ASME Joint Committee on the Effect of Temperatures on the Properties of Metals.** This Panel will review new or little used materials for power plant service, to determine whether sufficient information is available on them for commercial use. It was pointed out that the power industry has had to rely on manufacturers or consultants for the evaluation of these materials.

The Test-Methods Panel has under way a project to establish standard creep and rupture calibration specimens using type 316 steel. The heat of steel is being supplied by Universal-Cyclops Steel Corp. with the nickel donated by The International Nickel Co. The National Bureau of Standards will conduct the uniformity check tests. Final details on the dissemination of specimens, storing, and merchandising will be worked out at a meeting to be held in September.

40-YEAR MEMBERS RECOGNIZED AT AWARDS LUNCHEON

Aluminum Company of America
American Cast Iron Pipe Co.
The Broken Hill Associated Smelters, Proprietary, Ltd.
Canadian Locomotive Co., Ltd.
Central Scientific Co.
The Chapman Valve Manufacturing Co.
University of Chile, Laboratory for Testing Materials
D-X Sunray Oil Co.
University of Delaware, Department of Mechanics
Dominion Foundries and Steel, Ltd.
General Petroleum Corp.
S. C. Hollister
Inland Steel Co.
Iowa State Highway Commission
A. H. Jameson
City of Los Angeles, Bureau of Standards
Marblehead Lime Co.
L. S. Marsh
Mesta Machine Co.
The National Cash Register Co.
National Lumber Manufacturers Assn.
K. T. Potthoff
City of St. Paul, Bureau of Municipal Testing Laboratories
The Henry Souther Engineering Co.
Stewarts & Lloyds, Ltd.
E. Winthrop Taylor
Richard L. Templin
Townsend Co.
United States Smelting, Refining and Mining Co.
Vanadium Corporation of America
Vulcan Materials Co.

Non-Ferrous Metals

Industry may expect ASTM standards for zirconium and lithium to be published in 1958 as a result of present activities of **Committee B-2 on Non-Ferrous Metals and Alloys.** Also, active groups are being organized to consider standards for beryllium, columbium, tantalum, thorium, uranium, and hafnium when the need is indicated. New groups are being formed to look into the need for standardization of molybdenum and tungsten metals and alloys. Reports of the fact-finding groups mentioned above may later be published by ASTM as a matter of permanently recording the results of their investigations.

The committee has organized a subcommittee to consider specifications for titanium alloys, and to review the present specifications for titanium metal and titanium sponge.

Another symposium on solders and soldering is tentatively being planned for June, 1960. The 1956 symposium on this subject was so well received that another symposium appeared almost mandatory. The committee is also looking into the need for a symposium on zirconium, lithium, and other of the unusual metals to discuss test methods and to collect information for use in establishing standards.

Thermostat Metals

Control of temperature is such a common everyday affair—in home heating and cooling, in the laboratory, in ovens, furnaces, and many other applications—that it is often taken for granted and the user seldom gives a thought to the reliable little device, the thermostat. One reason for the reliability and predictability of this device is the work that has been going on for many years in the thermostat-metals subcommittee of **Committee B-4 on Metallic Materials for Electrical Heating, Electrical Resistance, and Electrical Contacts.** The group is continuing to improve the tests for thermostat metals and has about completed a revision of the method for flexivity of thermostat metals to extend the applicable range of thickness from 0.015 down to 0.003 in. Flexivity is the thermal deflection coefficient of thermostat metals. The group is also

Winner of the Frank E. Richart Award for notable contributions in the field of concrete was Stanton Walker (right) photographed at the Awards Luncheon with Frank E. Richart, Jr.

cooperating with Committee C-16 on Thermal Insulating Materials to develop a thermal emissivity test. Apparently similar methods can be used to measure thermal emissivity of metals and of thermal insulating materials.

A similar situation does not exist for measuring thermal conductivity of metals and thermal insulating materials. Methods for thermal conductivity of metals are being investigated jointly by the thermostat metals subcommittee and by the subcommittee on electrical contacts. An unusual approach is being taken in that a direct method is not contemplated. Instead the group has worked out a method for calculating the conductivity of the composite bi-metal from individual conductivities of each component which will be measured separately.

An important characteristic of heating alloys is the change in dimension when the material is heated. Information on this property is necessary in the design of electric furnaces, toasters, electric irons and other electrical heating devices so that the heating element may be properly supported at its working temperature. The committee is currently developing an accelerated life test for iron-chromium-aluminum alloys. Interlaboratory tests using both loop tests and straight wire tests indicate good agreement in measuring the change in resistance *versus* change in length for this alloy. Approximately 100 per cent change in resistance corresponds to 45 per cent change in length for this type alloy.

The subcommittee on contacts is continuing its investigation of surety of make of electrical contacts. Experiments using a sulfide film on the contact material show better agreement than previous tests using an oxide film.

● **Committee B-7 on Light Metals and Alloys** has authorized the formation of a special subcommittee on light metals for nuclear applications. This will be a fact finding group to establish the position of the committee in writing standards for light metals in the nuclear energy field.

The American Standards Association has adopted a system for codification of wrought aluminum and aluminum alloy products which the committee is considering in place of that presently outlined in Rec. Practice B-275 for codifying the products in the ASTM material specifications.

Construction Materials . . .

Committee C-1 on Cement reports progress in refining existing procedures and in filling of gaps where additional test methods are needed. In the first category is the refinement in procedure for the extraction of SO_3 from hardened portland-cement mortar through closer control of the temperature bath; revisions in sampling procedures; and revisions in the methods for determining free calcium oxide in portland cement and clinkers.

A new procedure for determining the ignition loss of portland blast-furnace slag cement was agreed upon. A method of test for determining the heat of hydration of portland blast-furnace slag cement has been prepared to be used as a basis for including limits in Specification C 205.

The influence of international standardization is noticed in the consideration of a minimum limit on relative humidity in cement laboratories which is in line with conditions being proposed by the International Standardization Organization. The proposed adoption of a 40 by 40 by 160-mm prism as the test specimen in the methods for flexural strength (C 348 – 54 T) and for compressive strength of Mortars (C 349 – 54 T) is an important step toward international standardization. Closer agreement between portland cement specifications of the American Association of State Highway Officials, the Federal Government, and ASTM will be effected as a result of discussions during the meetings.

Much attention has been focused on the proposed changes in the operating procedures of the Cement Reference Laboratory. It is the recommendation that the inspection be extended to cover concrete as well as cement testing and that the inspection should be provided at more frequent intervals than in the present program.

ASA Activity Renewed

Participation in international standardization was one of the principal items on the agenda of the meeting of **ASA Sectional Committee A-1 on Hydraulic Cements.** The committee approved a recommendation to ASTM as sponsor, that participation be arranged on ISO Technical Committee 74 on Hydraulic Binders with ASTM Committee C-1 on Cement functioning as the American Group. This recommendation will first be submitted to letter ballot of the entire membership of the Sectional Committee. If this recommendation is approved, all matters pertaining to international standards on cement will be referred by the American Standards Assn. directly to Committee C-1.

There was considerable discussion as part of the review of an analysis of the letter ballot returns on ASTM standards recommended for adoption as American Standards. Negative votes cast were in three general catagories; disapproval of recommendation of tentatives, standards which were either not generally used or were obsolete, and a preference for other than ASTM standards. After a critical review of the status of the sectional committee which had not held a meeting for 10 years, it was agreed to resubmit to the committee all standards which have been published on cement by the American Association of State Highway Officials, the Federal Government, the American Railway Engineering Assn. and ASTM. It was also recommended that the committee meet at more frequent intervals, preferably each year at the time of the Annual Meeting.

● The working life and setting time of chemical-resistant mortars are two important physical properties for which standard methods of test are required. The first draft of a proposed method was reviewed at the meeting of **Committee C-3 on Chemical-Resistant Mortars** with round-robin tests being

planned to obtain the necessary data. Absorption and apparent porosity are two other properties for which test methods have been prepared.

A final draft of a method of test for flexural strength of chemically setting silicate-type chemical-resistant mortar was agreed upon for acceptance at the next meeting of the committee.

● With the trend toward longer pipe lengths, there is need for review of the ASTM specifications for clay pipe to revise the necessary dimensional standards so as to provide heavier pipe where needed, particularly in increasing the thickness of shoulders. **Committee C-4 on Clay Pipe** will review and develop revised dimensional schedules and will review the titles and scopes of all of the pipe specifications under its jurisdiction for the purpose of classification and unification. Changes in the present strength requirements of extra strength perforated pipe will be studied.

● The need for a more suitable soundness test for lime to replace the existing method was emphasized at the meeting of **Committee C-7 on Lime.** The study of such a method will be intensified during the year with particular attention being given to surveying available research information.

A series of studies on the use of lime as a structural material, as well as a chemical reagent, were reported, working toward the development of new standards. The use of pozzolanic materials as an admixture with lime is the subject of a continuing study.

An interesting paper was presented at the main committee meeting by Emil Trottner, National Bureau of Standards, on the subject, "A New and Rapid Method for Determining Unhydrated Magnesia in Dolomitic Lime Hydrates."

● **Committee C-9 on Concrete and Concrete Aggregates** is preparing specifications and test methods for pozzolanic materials used to reduce expansion of concrete caused by alkali-aggregate reaction. Additional gradings to those covered presently in the Specification for Concrete Aggregates (C 33) will be considered to permit use of this standard for aggregates used in concrete products. The committee is continuing the study of pore structure of aggregates.

Abrasion resistance of concrete—significant property for certain applications—is the subject of an extensive study that has resulted in development of a proposed method known as the shotblast method. Acceptance at the next meeting is anticipated. The modulus of elasticity and Poisson's ratio of concrete cylinders will be evaluated by a test method which has now been prepared. Work will be initiated on specifications and methods of test for cotton mats for curing concrete. In this same field, revisions of the present specification for curing paper (C 171) have been agreed upon in subcommittee.

The effect of nuclear radiation on concrete was discussed briefly by a representative of Committee E-10 on Radioisotopes and Radiation Effects in which it was pointed out that concrete is included in the ceramic classification of materials and is considered high in resistance. Committee C-9 will meet in Mexico on December 5 to 6 in conjunction with meetings of Committee C-1 on Cement.

● Accessories used with gypsum and gypsum products in connection with wall construction received attention at the meeting of **Committee C-11 on Gypsum.** A proposed specification for joint tape and cement is about complete with a further report expected at the next meeting. Also being considered are specifications for paper used in gypsum board products and a method of test to evaluate mold resistance treatment of waste paper on gypsum formboard.

Further changes in the Specification for Gypsum Plasters (C 28) were accepted to provide the same strength requirements for all ready-mixed gypsum plasters. The committee is developing a method for determining compressive strength of gypsum plaster from field specimens.

● Efflorescence continues to be a primary subject of consideration in **Committee C-12 on Mortars for Unit Masonry.** As a result of further cooperative tests, a proposed method of test has now been developed which is suggested for publication as information.

The Specification for Mortar for Reinforced Brick Masonry (C 161) will be withdrawn; it has been superseded by the Specification for Mortar for Unit Masonry (C 270) which has now been published for six years and which includes all of the mortar mixes required for masonry work. Revision of other standards under the jurisdiction of the committee will be studied including the need for a change in the grading requirements in the Specification for Aggregate for Masonry Mortar (C 144) and air-entrainment requirements in masonry cement. Recommendations will be submitted to Committee C-1 on Cement for the elimination of the 12 per cent air-entrainment requirements for cement-lime mixtures in the Specification C 91.

A symposium on masonry mortars, sponsored by the committee, is planned for the 1958 ASTM Committee Week.

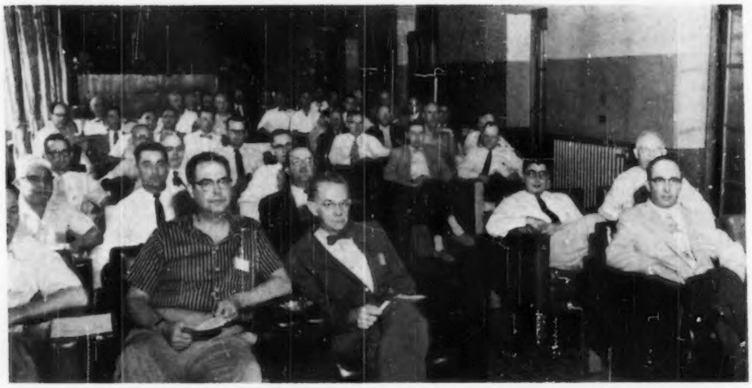
● Industrial floor brick is used in many industries and must be designed to cover diverse needs. The requirements of primary aluminum producers for floor brick are quite different from those of chemical manufacturers, and similarly, the needs of a builder for brick with which to pave an airport terminal building may be considerably different from those of food processing plants. A new specification for industrial floor brick was approved by **Committee C-15 on Manufactured Masonry Units,** subject to confirming letter ballot. The specification refers to four types, with physical and chemical properties established for each type in terms of the intended use. Low absorption and resistance to chemicals are primary requirements.

The drying shrinkage of concrete block has received considerable attention and discussion in the committee. Two proposed test methods have been reviewed, one, a modification of a British method requiring approximately two weeks for completion of test and the other, the Menzel relative-humidity method. More data are required by the committee before action on the acceptance of a proposed tentative method can be taken.

A task group has been formed to prepare a proposed method of test on water-repellent materials of the transparent type such as silicones, waxes, and stearates.

● Handleability of asbestos-cement products still remains a characteristic for which an evaluation test is desired. **Committee C-17 on Asbestos-Cement Products** is continuing its review of simulated service type of tests, including a pendulum impact test. The determination of organic fiber is the subject of a proposed test method on which round-robin tests are planned. Completeness of cure will be studied by a research group within the committee.

Agreement has not yet been reached on the proposed specification for



The main meeting of Committee D-18 on Soils for Engineering Purposes in Atlantic City. In the front row, third and fourth from left, are Chairman E. J. Kilcawley and Secretary W. G. Holtz.

asbestos-cement sewer pipe. New categories of pipe will be explored and Federal and Military specifications reviewed. The need for nomenclature was expressed and a group was authorized for this purpose. A subcommittee on research was also authorized with William Lerch, Portland Cement Assn., as chairman.

● The development of test methods will be the first and primary activity of the new **Committee C-23 on Sorptive Mineral Materials.** This committee, organized in February of this year, has established its subcommittee structure, and the first meetings were held during the Annual Meeting. Three task groups were set up within the Subcommittee on Methods of Sampling and Testing. Task Group A is charged with the responsibility of contacting industry for unpublished information, to determine from consumers their needs for test methods, and to carry out other contacts within industry. Task Group B will review the literature to collect all published sources of information pertinent to sampling and test methods, received from Task Group A all unpublished information, and then compile in the form of bibliographical abstracts material for publication by the Society. Task Group C will proceed with the development of test methods, using the background developed by the other two groups.

There is a real need for additional consumer representation on the committee and efforts will be made in this direction. An open invitation is extended to all members of the Society, particularly in the consumer category. The scope of the committee includes sorptive mineral materials used for surface maintenance and safety.

Road and Paving Materials

The important role of ASTM standards in the huge national highway program now under way was stressed at the meeting of **Committee D-4 on Road and Paving Materials.** Largely due to the highway program, there is extensive activity in the development and refinement of many test methods. A canvass of state highway, Bureau of Public Roads, and Canadian agencies, is being made to establish how widely used is the ASTM Method of Test for Vacuum Distillation of Liquid and Semi-Solid Asphaltic Materials (D 1189). A refinement in the Compressive Strength Method of Bituminous Mixtures (D 1074) was accepted. Cooperative tests will be conducted further to establish the advisability of using the single thermometer bath in the softening point test (D 36). A revision of the Los Angeles abrasion test method (C 131) will include weight tolerances in the large sizes of aggregates. The committee is making a further study of data, particularly for reproducibility, of a proposed rolling ball test method for evaluating the setting qualities of cut-back asphalts, and a proposed coating and stripping test method for bituminous mixtures was approved subject to confirming ballot.

The group of subcommittees responsible for specifications reported action on many revisions, principally concerned with the clarification of existing specifications. Some of these changes include: a change in grading in the specification for hot-mixed, hot-laid asphaltic concrete (D 947) in line with the usual practice of grading sand for this purpose; similar changes in the specifications for fine aggregate for sheet asphalt and bituminous concrete pavements (D 1073) and for asphaltic mixtures for sheet asphalt pavements (D 978). A revision of the Specification for Sodium Chloride (D 632) which will provide three classifications, namely rock salt, evaporated salt and fine grade rock salt, and a new specification for preformed expansion joint fillers, is expected to be completed soon.

The density of soil in place is a significant factor in foundation work. This can be determined by a proposed method using the sand cone procedure, which was accepted by the committee, subject to letter ballot.

A recommendation for the withdrawal of four specifications covering granite block and filler materials was significant in that it indicated the trend in highway pavement construction. The specifications for Cement Grout Filler for Brick and Stone Block Pavements (D 57), Sand-Cement Bed for Brick and Block Pavements (D 58), Coal-Tar Pitch for Stone Block Filler (D 112), and for Granite Block for Durax Pavements (D 132), are now considered as no longer used and therefore will be acted upon for withdrawal from publication.

"Statistical Techniques in Test Method Development" was the subject of a paper presented to the committee by Dale F. Fink, Shell Oil Co. Mr. Fink summarized the use of precision limits based on standard deviations to obtain more accurate test precision and included consideration of the skill of the operator, a logical system for rejection of test values, and more meaningful specifications and control limits.

● The development of standards for bituminized-fiber pipe is a new project to be undertaken by **Committee D-8 on Bituminous Waterproofing and Roofing Materials.** This represents a significant expansion of scope of this committee which recognized its 50th anniversary in 1955. Upon approval of the change in scope, additional personnel will be solicited to represent the producer and consumer interests in the field of bituminized-fiber pipe. A new subcommittee will be organized to develop standards for this product.

Coordination has been effected, by means of a special task group, in the physical requirements for mineral-surfaced rolled roofing as covered in ASTM Specification D 249 and Federal Specification SS-R-521.

● The determination of density of soil-in-place and moisture-density relations were two major subjects of discussion and action at the meeting of

Committee D-18 on Soils for Engineering Purposes on June 19. The sand-cone method for determining the in-place density of soils was approved subject to letter ballot. This method is restricted to tests in soils containing particles not larger than two inches in diameter. A method for determining the moisture-density relations of soils involving the use of a 10-lb tamper or hammer and an 18-in. drop and a method to evaluate the moisture-penetration resistance relation of soils were also approved.

A discussion took place on the scope of the proposed method of Thin Walled Tube Sampling of Soils. Action was taken to resubmit the method to the committee for letter ballot with changes which would clarify the scope in respect to relatively undisturbed samples.

The physicochemical properties of soils will be covered in a general treatise being prepared. A method for capillarity of soils is being developed, as well as two methods of measuring permeability.

The committee is sponsoring a joint meeting with the Mexican Society of Soil Mechanics which will be held in Mexico City during the week of December 9, 1957, at which time five half-day sessions of papers will be held with contributions from both the United States and Mexico.

Chemical Products, Fuels, Water . . .

• **Committee D-1 on Paint, Varnish, Lacquer and Related Products** and 85 of its subcommittees and working groups held meetings over a three-day period during the Annual Meeting. At a technical session, Sumner B. Twiss of Chrysler Corp. presented a paper on "Electron Microscope Study of Weathered Paint Films." The weathering of automotive finishes produces well recognized changes in the surface, resulting in such common defects as chalking, bronzing, and checking. The electron microscope was used to study these surface changes in considerable detail employing a two-stage replica technique. One study discussed was the comparison of the type of surface breakdown of a typical inorganic pigmented finish (light green) and a typical organic pigmented finish (dark maroon). Both an automotive lacquer and enamel were investigated under Florida exposure and exposure in the XW Weatherometer. Differences in natural and accelerated weathering effects were discussed. A more detailed study of automotive body enamels has been made, including most of the pigments commonly used in such finishes after exposure for one year in Florida. The correlation of the type and degree of surface breakdown with pigment properties was also noted.

Later in the year the committee plans to present four recommendations to the Society covering tests for color difference using the color eye, for color difference using the color-master colorimeter, a method of specifying color by the Munsell color system, and definitions of appearance terms.

A new group to consider preparation of concrete and masonry panels for weathering tests of protective coatings is studying an outline of specifications for two types of concrete panels for outdoor exposure tests and one type for artificial weathering tests. Details concerning portland cement, sand, water and masonry cement are to be carefully specified in keeping with recommendations of Committee C-9 on Concrete and Concrete Aggregates. Arrangements were made to undertake a cooperative series of round-robin tests.

A new subcommittee on statistical applications is being organized with tentative scope as follows: "To recommend statistical techniques for sampling materials, designing experiments, presenting data, and interpreting results; to review on request the adequacy of statistical procedures specified in existing or proposed test methods."

A working group on surface preparation of galvanized iron for painting has been established to outline effective treatments of galvanized strip, coil, or sheet for painting. Adherence of the paint film to the galvanized surfaces will probably be used as a measure of effectiveness of treatments prior to painting.

A new group on surface preparation of aluminized iron for painting has also been organized.

• **Committee D-2 on Petroleum Products and Lubricants** for the sixth consecutive year had the distinction of submitting to the Society the largest report, totaling 138 pages. Another indication of the tremendous activity of this committee was the ninety-nine meetings of its divisions, technical committees, and subcommittees held during the six days of the Annual Meeting.

The committee withdrew from its report as preprinted the recommendation for publication as tentative of the Test for Thermal Stability of Fuel Oils which is now published as information as an Appendix to the 1956 Report.

The committee deferred the adoption as standard of the Tentative Method of Test for Olefinic Plus Aromatic Hydrocarbons in Petroleum Distillates (D 1010 – 56 T) but approved the revisions as published in the annual report.

The committee is also planning to recommend for publication as information this year proposed methods for thermal stability techniques for jet fuels. These methods are based on work done by the Cooperative Research Council.

A new study group on nuclear problems will consider the effects of nuclear and high-energy radiation on petroleum products and lubricants. The Chairman of the study group is L. W. Manley, Socony Mobil Co.

The study group held its first meeting on June 30. The assignment of the group is to determine in what manner and to what extent work under the jurisdiction of the committee may or will be affected by the ever-increasing use of nuclear radiation. If enough interest and possibilities for active study are indicated, then the group is to suggest ways and means whereby Committee D-2 should take effective action.

Each of the members working individually will investigate certain applications and problems related to specific materials and test methods. A preliminary coordinated report of the study group may be available for presentation to the Advisory Committee at the fall meeting.

The committee appointed a special group to cooperate in the preparation of the 1960 revision of the U. S. Pharmacopoeia and the National Formulary. The group will advise on the latest methods of test and procedures under the jurisdiction of Committee D-2 which are of interest to and which appear in the U. S. Pharmacopoeia and National Formulary. Subjects of interest include petrola-

tum, white oils, pure hydrocarbons and hydrocarbon solvents, paraffin wax, thermometers, glassware and metalware apparatus, and mineral spirits.

The committee has about completed a revision of the Tentative Specifications for Gasoline (D 439 – 56 T) including a change in the minimum octane number requirements by the Research Method for both type A and B gasoline, increasing the present values by one unit.

Two proposed specifications and 13 proposed methods of test were submitted for publication as information. Perhaps the most significant of these are the proposed specifications for aviation turbine fuels which define two types of such fuels: type A a relatively high-flashpoint distillate of the kerosine type, and type B a relatively wide-boiling-range volatile distillate. These two types of fuel are for civil airplane use and are intended for use by purchasing agencies in formulating specifications for purchases of aviation turbine fuels under contract. The other specification covers glassware and metalware equipment for the distillation test and was prepared in cooperation with Committee E-1 on Methods of Testing.

An important addition was made this year to the Standard Method for Conversion of Kinematic Viscosity to Saybolt Furol Viscosity (D 666 – 53). The present method provides means for converting viscosity data at 122 F; the revision provides also for conversion at 210 F. In line with this revision, corresponding changes will be made in the ASTM Viscosity Tables, *STP No. 43 A*.

Technical Committee M on Paraffin Wax, a joint project of the ASTM and the Technical Association of the Pulp and Paper Industry, has developed two methods recommended as tentative in the Committee D-2 Report. These cover methods of test for odor intensity of petroleum wax and for 20-deg specular gloss of wax paper. Also recommended by Technical Committee M are revisions of the methods of test for melting point of paraffin wax (D 87), for tensile strength of paraffin wax (D 1320), and for needle penetration of petroleum waxes (D 1321).

Another accomplishment this year was extensive revision of the method for heat of combustion of liquids (D 240). This method was last revised seven years ago, but had previously not been modified since 1939. In support of the revisions, the committee submitted a summary of the cooperative test data of four samples analyzed by 14 laboratories to determine the repeatability and reproducibility of the method.

Some further editorial changes will be made in the revised Tentative Method of Test for Sulfur in Petroleum Products and Liquefied Petroleum Gases by the CO_2-O_2 Lamp Method (D 1266). This method was extensively revised this year.

At the Annual Dinner of Committee D-2 the guest of honor was Dr. William S. James, of W. S. James & Associates, Birmingham, Mich. Mr. James has been chairman of Technical Committee B on Lubricating Oils since 1946 and has been a member of Committee D-2 for twenty-nine years.

W. T. Gunn, Secretary of Committee D-2 served as toastmaster. The many accomplishments and contributions to the committee and the petroleum industry made by the guest of honor were described with a number of interesting slides by Dr. D. B. Barnard, Standard Oil Co. (Indiana).

Meeting in Atlantic City—Subcommittee XIX on Putty, Glazing and Caulking Compounds of Committee D-1 on Paints, Varnish and Lacquers.

• A new approach to the determination of weight per cubic foot of crushed bituminous coal was presented for consideration as a revision of Standard Method D 291 at the meeting of **Committee D-5 on Coal and Coke.** Interlaboratory test programs for the study of methods for ash fusion and chlorine analysis of coal were established. The committee also reviewed a variety of the methods for sulfur determination of coal in order to establish further work in this area.

Printed Circuits Challenge Insulation Group

Automation in the electronics industry has been given a forward boost with the development and widespread use of printed circuitry. With this development have come problems in the evaluation of the properties of copper-clad plastic laminates which form the basis for most printed circuitry. A complicating factor in the evaluation of electrical properties of these laminates is the fact that in the application in printed circuits, an etching solution is used to remove the unwanted portion of the copper foil, leaving the wiring pattern. The etching solution and subsequent treatment affects the surface properties of the exposed laminate which serves as the insulation between the wiring and circuit elements. An important property of this material is its insulation and surface resistance, especially at high humidities. Development of a satisfactory procedure for measuring this property for copper-clad laminates is a continuing project of **Committee D-9 on Electrical Insulating Materials.** The committee agreed that the problem is primarily one of control of the test conditions and not of making the measurements which are adequately covered by Methods D 257. It was felt that research on this problem is needed and a task group was appointed to prepare a statement of the problem for possible consideration as a sponsored research project in cooperation with NEMA and RETMA.

At the meeting, the committee initiated a project on electrostatic phenomena. The first step will be to survey the literature, particularly with regard to measuring electrostatic charge. The objective of the group

is to develop standard test methods that can be used for evaluating the tendency for insulating materials to obtain and hold an electrostatic charge. It was indicated that the group will not be concerned with methods for eliminating static charge.

The committee is actively working in the field of corona testing and measurement and has sponsored the publication, with the Annual Report, of a suggested method for corona measurement. Progress is being made also on a method for determining corona resistance of insulating materials.

The committee is continuing its extensive program of work in developing standards for insulating liquids, including varnishes and oils, insulating fabrics, papers, mica, and filling compounds, as well as test methods for magnet wire insulation. These activities are covered fully in the Annual Report of the committee.

● A special technical feature of the meeting of **Committee D-11 on Rubber** was the presentation of two technical papers:

"Dimensional Tolerances," by George J. Crowdes, Simplex Wire and Cable Co.

"Flexing Apparatus for Ozone Testing," by Dale J. Milnes, Ozone Equipment Division of Mast Development Co.

In its annual report, the committee presented two new tentative methods to the Society as listed elsewhere in this BULLETIN. In addition, the committee made extensive revisions in three of its tentative methods and presented to the Society recommendations affecting 15 other standards and tentatives.

The Tentative Methods of Sample Preparation for Physical Testing of Rubber Products (D 15 – 55 T), was revised to include the latest standard ingredients now available from the National Bureau of Standards required for use in the preparation of standard rubber compounds for testing. The recipes and standard formulas cover not only natural rubber compounds but also the various synthetic rubbers including those for styrene-butadiene, neoprene, butyl, and nitrile. These standard formulas are used extensively throughout the rubber industry in the testing and evaluation of rubber compounds.

Another important revision this year was made in the general Tentative Methods of Testing Rubber Hose (D 380 – 57 T). The methods now include the latest procedures used in testing hose for automotive uses and for many general industrial applications.

● A proposed method for the determination of fatty acids content of tall oil rosin was reviewed at the meeting of **Committee D-17 on Naval Stores.** This new method is designed to determine the quality of separation of acids from tall-oil rosins. A collaborative test on two methods for determining rosin acids indicated that both the modified Wolfe and the Linder-Persson methods provide equally good results. Further study of the relative merits of these two methods is planned.

● Though the significance of the dissolved oxygen content of industrial water has long been recognized, there remains a question as to which methods are best for its determination. Much valuable information on this subject was presented in the papers and discussion at the Symposium on Determination of Dissolved Oxygen in Water, sponsored by **Committee D-19 on Industrial Water.**

Arrangements were made to expand work in connection with radioactivity in industrial water through development of methods of test, preparation of a bibliography and holding a symposium on radioactivity in industrial water to be recommended for presentation at the 1958 Annual Meeting.

Action was taken to withdraw from the preprinted report the recommendation for publication as tentative of Methods of Test for Appearance Properties of Industrial Water and Industrial Waste Water, pending extensive editorial revision and subdivision into smaller, closely related groups of properties to be recommended for publication under separate designations.

As the result of constructive criticisms to the effect that additional information on scope, application, and interferences would be desirable in some of the ASTM methods of testing industrial water, action was taken to arrange for the necessary revision and expansion of these sections in current methods, with particular consideration to be given to making these sections satisfactorily complete in all subsequent methods.

Substantial progress was reported in the preparation of the new chapters for the second Edition of the Manual on Industrial Water. However, the magnitude of the task has become increasingly evident, with work on the Second Edition now expected to be completed sometime in 1958.

Plastics: How Durable?

Plastics are increasingly being used in applications where it is hoped they will last for many years. Since the plastics industry is relatively young, there are many plastics which are so new that there are no long-term data upon which to base predictions as to their permanence. In these cases it is necessary to depend upon accelerated tests or, in the case of outdoor weathering, artificial weathering tests. Therefore, much of the interest and effort in **Committee D-20 on Plastics** was concerned with these problems. The committee approved the method for artificial weathering using a fluorescent sun lamp and fog chamber which is intended to supply useful data on permanence of plastics. The committee is currently developing a fading standard consisting of an acrylic-base plastic containing a dye for use in calibrating artificial weathering and light exposure machines. Specimens of the fading standard are being prepared for use in a round-robin evaluation program. The committee has also established a test program to evaluate corosivity of plastics, that is, the tendency of plastics to influence corrosion of metals with which they are in contact.

Because of the very wide spectrum of properties of commercially available polyethylenes, the problems of writing a generally applicable specification are difficult. It is recognized that the present specification D 1248 is out of date because of rapid developments in the polyethylene field. Progress is being made, however, in drafting an improved version of this specification. Reproducible test methods are not yet available for certain properties of polyethylene, in particular the tendency for the material to crack under certain environmental conditions, and the measurement of solution viscosity. No really good solvent has been found that can be used to measure accurately the solution viscosity.

Solution viscosity of vinyl chloride polymers and co-polymers presents fewer problems and the committee is revising Method D 1243 to provide an alternate method using cyclohexanone. The present method employs nitrobenzene. Solution viscosity is related

to the molecular weight of the polymer.

A number of editorial changes were made in the committee's recommendations in its Annual Report in order to resolve negative ballots. It was necessary to withdraw the proposed Tentative Specification for Glass Fabric Reinforced Epoxy Laminates. Also the recommendation to change the title of the Test for Heat Distortion Temperature of Plastics (D 648) was not approved by the committee. The committee also withdrew its recommendations for revision of specifications D705 and D 1201 covering urea and polyester molding compounds.

Carbon Black Tests Approved

Few committees having been established only one year would be able to complete as many actions in a short time as did **Committee D-24 on Carbon Black** in its first report to the Society following its organization in 1956. Included in its 1957 annual report and already approved by letter ballot of the committee are nine tentative methods of test for various properties of carbon black. This rapid progress is largely due to the background work of the Carbon Black Industry Committee in developing and evaluating the methods prior to the organization of the committee in 1956.

Methods recommended for publication as tentative cover pellet-size distribution, attrition, sieve residue, pour density, fines, ash, heating loss, pH, and iodine adsorption of carbon black. All these methods are useful in characterizing the properties of carbon black which are of interest to both producers and consumers of the material.

There is considerable interest in the committee in developing procedures for sampling both hopper cars and bags, and task groups have been established to develop and carry out test programs on these two types of sampling problems.

● **Committee D-25 on Casein and Similar Protein Materials** reviewed a collaborative program to evaluate a method of testing the moisture content of casein and soya protein. Collaborative work on sieve analysis and viscosity was also reviewed. Since the results of this first test series showed considerable variation, a new test program is now under way. A review of test methods used to distinguish soya protein and casein are being studied in order to establish a qualitative method.

The committee also discussed methods for nitrogen, fixed ash, fat, free acid, pH, and total acidity.

Analysis and Testing . . .

● The Subcommittee on Microscopy of **Committee E-1 on Methods of Testing** sponsored an informal discussion on noncommercial microscopic accessories. At the session there were presented brief discussions on the following nine subjects:

1. Hot Stages in Conducting Glass, by R. P. Loveland, Eastman Kodak Co.
2. Suggested Techniques in Photomicrography, by H. W. Zieler, H. W. Zieler Co.
3. Saylors Double Diaphragm Optical System, by H. F. McMurdie and S. B. Newman, National Bureau of Standards
4. Stereo Photomicroscopy, by O. W. Richards, American Optical Co.
5. Holder for Dyeing Short-Length Filaments or Yarns, by F. F. Morehead, American Viscose Co.
6. Ultra Thin Sectioning, by A. F. Kirkpatrick, American Cyanamid Co.
7. Petrographic Techniques, by Joseph Berman, U. S. Department of the Interior
8. Specimen Holder for Low Power Study, by F. G. Foster, Bell Telephone Laboratories
9. Accessory Equipment for Polishing, by Wm. A. Olsen, Uddeholm Steel Co.

There was an excellent attendance at the session and the presentation of these papers was followed by an active discussion. This informal discussion provided an excellent opportunity for a general exchange of information by those interested in microscopic techniques and apparatus. This was the third annual session of this type and the committee plans to sponsor a similar session at the 1958 Annual Meeting.

The new Task Group on Laboratory Balances considered at its meeting the first draft of Proposed Specifications for Laboratory-Type Balances. This was a rather complete specification and covered statements on: basic concepts and terminology, classification of instruments, basic concepts and measurement, definitions of terms that apply generally to indicating instruments of this type, tolerances for balances, and reading methods.

The immediate activities of this committee will be devoted to the establishment of basic terminology for balance performance and standards on performance testing.

Committee E-1 is planning a symposium on particle-size measurement which it expects can be arranged for the 1958 Annual Meeting of the Society.

The committee presented for publication as information proposed specifications for distillation equipment which combine all of the metalware and glassware apparatus now used in six ASTM standards. When these specifications are issued as tentative, they will be available for reference in the other distillation methods, thus effecting an economy in printing and further standardization of distillation apparatus by describing all of the equipment in one place.

The Method of Bend Testing for Ductility of Metals (E 16 – 39) was extensively revised and brought up to date this year. This method covers the "free-bend" test for determining the ductility of welds in welded butt joints. The soundness of a weld and the quality of fusion to the base metal are severely tested. Welds that have been X-rayed and found to have allowable defects, such as very slight porosity, have been known to fail in this test. Defects such as lack of fusion, cracks, or porosity, at or near surface of the tension side of the weld will cause the specimen to fail in the bend test because of progressive localized overstressing. This method has been developed primarily for the testing of welds and is not intended to be substituted for the more simple and wholly adequate bend test requirements in the ASTM specifications for various wrought steel products.

The Methods of Test for Thickness of Solid Electrical Insulation (D 374 – 42), which has now been placed under the jurisdiction of Committee F-1, was revised this year to include procedures for calibration of spindle pressure on rachet micrometers. This method is now widely used for testing a variety of materials and the committee plans to revise the title and scope of the method, at which time it will be assigned an "E" designation.

● Final arrangements were made for the second edition of the book of "Methods of Emission Spectrochemical Analysis." Five new tentatives issued under the jurisdiction of **Committee E-2 on Emission Spectroscopy** since the publication of the first edition will be included. More than twenty suggested methods will be included in addition to those appearing in the first (1953) edition.

Presented as part of the committee's report to the Society was a Tentative Recommended Practice for Designation of Shapes and Sizes of Preformed Graphite Electrodes. While not intended to preclude the use of other special shapes and sizes of electrodes, this practice should provide a basis for some degree of standardization of shapes and sizes of electrodes most generally and readily available. One

of the major problems thus far in standardization of methods for emission spectrochemical analysis has been extreme variations in available apparatus and materials. The recommended practice for electrodes provides a beginning toward standardization of apparatus and materials so as to simplify description of apparatus and materials in ASTM methods written or revised henceforth.

● Much interest was shown in the Symposium on Gases in Metals sponsored by **Committee E-3 on Chemical Analysis of Metals.** Particular emphasis was placed on the determination of oxygen, with three of the five papers being devoted specifically to that subject.

Arrangements were made to sponsor a Symposium on Solvent Extraction in Chemical Analysis for the Annual Meeting in 1958.

New task groups were organized to study methods for the determination of very small amounts of carbon and sulfur (less than 0.005 per cent of each) in steels.

● A new draft of "A Guide for Fatigue Testing and the Statistical Analysis of Fatigue Data" was distributed for comment to **Committee E-9 on Fatigue** which met during the Annual Meeting. A summary of the comments and recommendations will be prepared and the Guide submitted to committee ballot. On final approval, the Guide will be published by the Society as a Special Technical Publication. The Guide is a project of the Task Group on Statistical Methods, F. B. Stulen, chairman. In preparing this latest draft, the group held eight meetings and put in more than 400 man-hours of work during the 3-month period preceding the annual meeting.

● The principal activity of **Committee E-14 on Mass Spectrometry** at its meeting May 20 to 24 was the presentation of some 60 technical papers on both fundamentals and applications of mass spectrometry, by scientists from many parts of the world. This was a most successful meeting with a record number of almost 400 in attendance. Special features this year were a half-day discussion meeting on solids techniques, a half-day discussion meeting on new instruments and instrumental techniques, a symposium on negative ions, and a mass spectrometer clinic sponsored by the Consolidated Electrodynamics Corp.

A task force has prepared a recommended practice for the evaluation of the suitability of mass spectrometers for use in methods of chemical analysis. A letter ballot is now being circulated to the subcommittee for the acceptance of this. Another task force has reviewed a proposed method of test for hydrocarbon types in gasoline by mass spectrometry prepared by Committee D-2 on Petroleum Products. Three subcommittees are preparing reviews of the technical literature in their field for the last year. Another task group is collecting a file of uncertified mass spectra for distribution, and a task group has prepared a recommendation for coding and handling of mass spectrometer data on IBM cards. The committee has enlarged its program for giving financial assistance to aid foreign experts to attend its meetings.

The rapid expansion of the committee in its five years of existence to include such a large number of representatives from broad fields of interest in mass spectrometry is evidence of the industrial importance of this field.

Noah Kahn

We regret to announce the death of Noah Kahn, Department of the Navy, who succumbed to a heart attack on the beach at Atlantic City, June 20, during the ASTM Annual Meeting.

Mr. Kahn had a long and active record of service as an ASTM member and committee member. He was a pioneer and one of the country's leading authorities on radiography. One of his most important accomplishments was his work in the preparation of Reference Radiographs for steel welds for use in the field of nondestructive testing.

These Annual Meeting Papers Are Still Available

SOME of the papers which were not preprinted for the 1957 Annual Meeting were mimeographed primarily for the use of those interested in presenting discussion. A limited number of these are available from ASTM Headquarters, 1916 Race St., at a nominal charge.

The Use of a Field Vane Apparatus in Sensitive Clay by W. J. Eden and J. J. Hamilton

The Permeability of Soils and the Concept of a Stationary Boundary-Layer by W. E. Schmid

Design and Deflection Control of Buried Steel Pipe Supporting Earth Loads and Live Loads by Russell Barnard

The Fatigue Properties of Decarburized Steel by G. T. Horne and H. A. Lipsitt

Cracking of Notch Fatigue Specimens by M. S. Hunter and W. G. Fricke

The Freeze-Thaw Resistance of Concrete as Affected by the Method of Test by H. L. Flack

Performance Tests of Concrete Truck Mixers by A. G. Timms

Cement-Aggregate Reaction in Concrete of a Canadian Bridge by E. G. Swenson

A Canadian Reactive Aggregate Undetected by ASTM Tests by E. G. Swenson

Studies of Flexural Strength of Concrete. Part 3. Effects of Variations in Testing Procedures by Stanton Walker and D. L. Bloem

Application of Vacuum Fusion to Gas-Metal Studies by W. G. Guldner and A. L. Beach

Fatigue Testing of Airframe Structural Components by H. W. Foster

Fretting Corrosion of Large Shafts as Influenced by Surface Treatments by O. J. Horger and H. R. Neifert

A Quarter Century of Propulsion Shafting Design Practice and Operating Experience in the U. S. Navy by R. Michel

The Directionality of Beryllium Copper Strip as Affected by Cold Rolling and Heat Treating by J. T. Richards and K. Murakawa

Embrittling Tendencies of Austenitic Superheater Materials at Elevated Temperatures by J. H. Hoke, F. Eberle, and R. D. Wylie

Constant Stress, Creep-Rupture Tests of a Killed Carbon Steel by P. N. Randall

Effect of Composition on the Elevated Temperature Properties of Ductile Iron by R. D. Schelleng and J. T. Eash

Polarographic Measurements of Dissolved Oxygen by W. W. Eckenfelder, Jr., and C. Burris

The Beckman Oxygen Analyzer by T. Finnegan and R. C. Tucker

Evaluation of Hartman and Braun Dissolved Oxygen Recorder by A. J. Ristaino and A. A. Dominick

Determination of Dissolved Oxygen by Means of a Cambridge Analyzer by H. A. Grabowski

New Tentatives

At the 60th Annual Meeting the Society accepted 90 new tentative specifications and methods of test, the titles and designations of which are given below, with brief notes on their significance. Other actions taken at the meeting in regard to standards are summarized in the box.

The numerical designations of the technical committees responsible for these tentatives are shown after the boldface headings.

Steel (A-1)

Specifications for:

High-Strength Structural Alloy Rivet Steel (A 406 – 57 T)

This steel is used to manufacture rivets for structures made of one of the many proprietary high-strength, low-alloy structural steels.

Upholstery Spring Wire for Coiled Type Springs (A 407 – 57 T)

Last year, as a result of urgent requests from the cold-drawn steel spring wire industry, Committee A-1 organized a new subcommittee to establish industry-wide ASTM standards for these products. This is one of those for which an early need was expressed.

Special Large Size Deformed Billet Steel Bars for Concrete Reinforcement (A 408 – 57 T)

The AISI Committee on Reinforced Concrete Research was asked two years ago to develop background on the application of Nos. 14 and 18 bars. A year ago the AISI Committee reported little likelihood of any research on these large bars. At that time as a result of formal requests from the Corps of Engineers and the Bureau of Reclamation, A-1 Sub V decided to develop these specifications.

Welded Large Outside Diameter Light Wall Austenitic Chromium Nickel-Alloy Steel Pipe for Corrosive or High Temperature (A 409 – 57 T)

Several years ago the Chemical Industry Advisory Board of ASA petitioned Committee A-1 to develop specifications for electric-fusion-welded light-wall chromium-nickel alloy steel pipe in diameters of 14 to 30 in. for use in chemical processing plants. Development of the specifications has been a difficult task, primarily because the representatives of the chemical industry desired steel compositions which were not standard with the steel industry and purchaser requirements had to be balanced against steel industry production.

Chromium-Copper Nickel-Aluminum Alloy Steel Plates for Pressure Vessels (A 410 – 57 T)

This steel composition is one with which the Carbide and Carbon Chemicals Co. has had much experience in its chemical processing equipment. Corollary specifications for tubular products, forgings, etc., are being developed. The steel has excellent low-temperature properties.

Corrosion of Iron and Steel (A-5)

Specification for:

Zinc-Coated (Galvanized) Low-Carbon Steel Armor Wire (A 411 – 57 T)

Developed to cover the important field of corrosion-resistant wire for buried or submerged steel cables.

Iron-Chromium-Nickel Alloys (A-10)

Specification for:

Corrosion-Resisting Chromium-Nickel-Manganese Steel Plate, Sheet and Strip (A 412 – 57 T)

This specification covers the new types 201 and 202 corrosion-resisting steels, developed as a result of the nickel shortage. Type 201 has been found to be a satisfactory substitute for type 301 applications where severe forming characteristics are not too important. Type 202 has been found to be a satisfactory substitute for type 302 applications where severe forming characteristics are important.

Wires for Electrical Conductors (B-1)

Specification for:

Aluminum Wire for Communication Cable (B 314 – 57 T)

With the increasing availability of electrical-conductor grade aluminum and the shortage of copper in recent years, the application of aluminum to conductor uses other than bare overhead transmission has been growing. Committee B-1 has recognized this trend and has been developing specifications for several particular types of aluminum conductors, of which this is one type.

Copper (B-5)

Specification for:

Copper-Silicon Alloy Seamless Pipe and Tube (B 315 – 57 T)

Several years ago G. H. Bohn of the Linde Co. in a technical paper outlined his views on the chemical composition of copper silicon alloy products. Mr. Bohn had spent a great deal of time correlating the composition of the alloy with mechanical processing information. This specification is the result of Committee B-5 deliberations on Mr. Bohn's work.

Light Metals (B-7)

Specifications for:

Aluminum Alloy Rivet and Cold Heading Wire and Rods (B 316 – 57 T)

Of particular significance in this specification is standardized equipment and requirements for shear testing heat-treated aluminum alloys in wire and rod form. The use of aluminum alloys in rivets and utility items formed by cold die-heading operations has been steadily increasing.

Extruded Aluminum-Alloy Bars, Rods, Pipe and Structural Shapes for Electrical Purposes (Bus Conductors) (B 317 – 57 T)

The increasing availability of electrical conductor grade aluminum alloys and the shortage of copper dictated the necessity for this industry-wide standard. One method for satisfactorily performing the indicative flatwise bend test is outlined in the specifications.

Type A and Type B Aluminum-Alloy Drawn Annealed Seamless Coiled Tubes (B 318 – 57 T)

This specification fulfills the need for standardizing aluminum-alloy coiled tubes used in instrument, lubrication, air, and distilled water lines, and in gas and liquid fuel lines.

Electrodeposited Metallic Coatings (B-8)

Recommended Practice for:

Preparation of Lead and Lead Alloys for Electroplating (B 319 – 57 T)

This is another practice developed by Committee B-8 in its program to have available directions for the preparation of electroplating of all commercially used metals.

Chemical-Resistant Mortars (C-3)

Specification for:

Resin-Type Chemical-Resistant Mortars (C 395 – 57 T)

This covers the second in the group of four types of chemical-resistant mortars being commercially produced and used for which standards are being developed. A Specification for Sulfur Mortar (C 287) has already been published and the committee is now working on specifications for silicate-type mortars.

Method of Test for:

Compressive Strength of Chemically Setting Silicate-Type Chemical-Resistant Mortars (C 396 – 57 T)

This companion method to the Method for Compressive Test for Resin-Type Chemical-Resistant Mortars (C 306), is the first of several methods under consideration on silicate-type mortars.

Recommended Practices for:

Silicate-Type (C 397 – 57 T), Hydraulic (C 398 – 57 T), and Resin-Type (C 399 – 57 T) Chemical-Resistant Mortars

The committee has felt it feasible to develop a recommended practice for the use of each of these several mortars for which standards are being developed. It is important that these types be stored, mixed, and used under carefully controlled conditions in order to obtain the best type of bonding and the optimum chemical resistance, as well as strength.

Lime (C-7)

Methods of:

Testing Quicklime and Hydrated Lime for Neutralization of Waste Acid (C 400–57 T)

Refractories (C-8)

Tentative Classification of:

Castable Refractories (C 401 – 57 T)

This covers the important field of hydraulic-setting refractories which is now covered only by test methods.

Concrete (C-9)

Specification for:

Raw or Calcined Natural Pozzolans for Use as an Admixture for Portland Cement (C 402 – 57 T)

This specification provides a measure of quality control for these materials. Natural pozzolans that may be used include diatomaceous earths, opaline cherts and shales, tuffs, and volcanic ashes or pumicites.

Method of Test for:

Measuring the Rate of Hardening of Mortars (C 403 – 57 T)

The Proctor Penetration needle is used to determine the effects of variables such as temperature, cement, mix design additions, and admixtures on the hardening characteristics of concentrate.

Mortars for Unit Masonry (C-12)

Specifications for:

Aggregates for Masonry Grout (C 404 – 57 T)

It has been found necessary to develop a particular grading of the aggregate as well as control of the deleterious substances and organic impurities.

Thermal Insulation (C-16)

Methods of Test for:

Consistency of Wet-Mixed Thermal Insulating Cement (C 405 – 57 T)

Natural Building Stones (C-18)

Specification for:

Roofing Slate (C 406 – 57 T)

Up to this time there has been no published standard specification covering quality of building stones as measured in terms of their physical properties. Other specifications in process of development include those for granite, limestone, marble, and sandstone.

Structural Sandwich Construction (C-19)

Methods of Test for:

Flatwise Flexure Strength of Sandwich Construction (C 393 – 57 T)

This new method adds to the growing group of standards used for evaluating sandwich constructions as used in both aircraft and building structures.

Shear Fatigue of Sandwich Core Materials (C 394 – 57 T)

Fatigue is an important characteristic in sandwich construction, particularly when used in aircraft. This method outlines the procedure for determining shear fatigue of core materials as used in sandwich construction.

Ceramic Whitewares (C-21)

Method of Test for:

Compressive (Crushing) Strength of Fired Whiteware Materials (C 407 – 57 T)

This test is one of several physical tests which are currently being worked on by Committee C-21.

Thermal Conductivity of Whiteware Ceramics (C 408 – 57 T)

This property is one of increasing importance, particularly in view of the wider use of ceramic materials in the electronic and aircraft industries.

Porcelain Enamel (C-22)

Method of Test for:

Torsion Resistance of Laboratory Specimens of Porcelain Enamelled Iron and Steel (C 409 – 57 T)

Paint, Varnish, Lacquer (D-1)

Methods of Test for:

Fatty Acids Used in Protective Coatings (D 1467 – 57 T)

These methods provide complete instructions for determining color, titer, acid value, iodine value, saponification value, and unsaponifiable matter.

Volatile Matter in Tricresylphosphate (D 1468 – 57 T)

This method formerly appeared in the general Methods of Sampling and Testing Lacquer Solvents and Diluents (D 268-53). It has now been revised and is being issued as a separate tentative.

Total Rosin Acids Content of Coating Vehicles (D 1469 – 57 T)

This method covers a procedure for determining total rosin acids content of normal rosin esters, varnishes, and alkyd resins, unmodified by such materials as maleic or fumaric acid, or phenols. Total rosin acids determined include free rosin, esterified rosin, and metallic salts of rosin. Applicability to separated paint vehicles has not yet been determined.

Two-Parameter 60-Deg Specular Gloss (D 1471 – 57 T)

This method is a companion test to the 60-deg geometry of specular gloss as determined by ASTM Method D 523. Measurements by this latter method do not always correlate with glossy appearance. A measurement with a small receiver aperture is required to supplement test by D 523 to obtain more information about the geometric distribution of reflected flux and about the appearance characteristics. Although this method was developed primarily for testing clear organic finishes on wood, it may reasonably be used for other nonmetallic materials.

Color-Difference Using the General Electric Spectrophotometer (D 1472 – 57 T)

This method covers a test procedure for determining small daylight color differences of nonfluorescent opaque specimens having similar physical characteristics. Small color differences between reflecting specimens of different surface texture cannot be accurately evaluated by this method.

Oil Absorption of Pigments by Gardner-Coleman Procedure (D 1473 – 57 T)

This method provides a second ASTM test for oil absorption of pigments. In the present method D 281, the oil absorption is determined by rubbing up the pigment on a glass slide with small additions of oil until it produces a very stiff putty-like paste which does not break or separate. In this new method the oil absorption is determined by forming the paste by the dropwise addition of oil to the gently stirred pigment in the Gardner-Coleman glass container.

Knoop Indentation Hardness of Paint, Varnish, and Lacquer Coatings (D 1474 – 57 T)

This method determines the hardness of dried paint film applied to a plane rigid surface such as metal or glass. The test load is applied to the surface of the coating through a pyramidal-shaped diamond having specified angles. The measurement of the resultant permanent impression is converted by a formula to a Knoop hardness number.

Density of Paint Type Materials (D 1475 – 57 T)

This method describes a procedure for the measurement of density of paints, varnishes, lacquers, and components thereof, other than pigments, when in fluid form. It is par-

SUMMARY OF ACTIONS TAKEN AT 1957 ANNUAL MEETING AFFECTING STANDARDS AND TENTATIVES.

	New Standard and Existing Tentatives Adopted as Standard	Standards in Which Revisions Will Be Adopted	New Tentatives	Revisions of Standard and Reversions to Tentative	Tentative Revisions of Standards	Existing Tentatives Revised	Standards and Tentatives Withdrawn
A. Ferrous Metals—Steel, Cast Iron, Wrought Iron, Alloys, etc.	1	17	6	...	1	25	...
B. Non-Ferrous Metals—Copper, Zinc, Lead, Aluminum, Alloys, etc.	4	16	6	...	...	30	3
C. Cement, Lime, Gypsum, Concrete and Clay Products	11	18	17	2	5	21	1
D. Paints, Petroleum Products, Bituminous Materials, Paper, Textiles, Plastics, Rubber, Soap, Water, etc.	44	33	54	14	9	59	7
E. Miscellaneous Subjects, Testing, etc.	4	4	12	2	...	4	...
F. Electronic Materials	...	...	1	...	...	1	...
Total	64	88	90	18	15	140	11

ticularly applicable where the fluid has too high a viscosity or where a component is too volatile for a specific gravity balance determination.

Heptane Miscibility of Lacquer Solvents (D 1476 – 57 T)

This method may also be used to detect qualitatively the presence of moisture in esters and ketones. It was formerly described in the Standard Methods of Sampling and Testing Lacquer Solvents and Diluents (D 268 – 53) and is now being established as a separate tentative.

Petroleum Products (D-2)

Methods of Test for:

Low-Temperature Torque of Ball Bearing Greases (D 1476 – 57 T)

This method of test determines the extent to which a low-temperature grease retards the rotation of a slow-speed ball bearing when subjected to subzero temperature. It has been developed employing greases having extremely low-torque characteristics at –65 F and may not be applicable to other greases, speeds, or temperatures. Low-temperature torque is defined as "The force in gram-centimeters required to restrain the outer ring of a No. 204 size open ball bearing lubricated with the test grease while the inner ring is rotated 1 rpm at –65 F."

Measuring the Color of Petroleum Products ASTM Color Scale (D 1500 – 57 T)

This method employs a new set of 16 glass color standards for the visual determination of the color of a wide variety of petroleum products such as lubricating oils, heating oils, diesel fuel oils, and petroleum waxes. The method is intended to supersede the present ASTM Method D 155, Color of Lubricating Oil and Petrolatum by Means of ASTM Union Colorimeter and is superior in three respects: (1) The glass standards are specified in fundamental terms; (2) the differences in chromaticity between successive glass standards are uniform throughout the scale; and (3) the lighter colored standards more nearly match the color of petroleum products.

Freezing Point of Aviation Fuels (D 1477 – 57 T)

This method provides a procedure for detecting separated solids in aviation reciprocating engine and turbine engine fuels at temperatures likely to be encountered during flight or on the ground. The method is identical in substance with the test described in Federal Standard 791 and also is a revision of the procedure formerly published in the ASTM Specifications for Aviation Gasolines (D 910 – 56 T).

Emulsion Stability of Soluble Cutting Oils (D 1479 – 57 T)

This method describes a general procedure for determining the stability of emulsions of soluble cutting oils. It was published as information in the 1955 Report of Committee D-2. Results of cooperative work carried on in the study of this method were also reported in 1955.

Density and Specific Gravity of Viscous Materials and Melted Solids by Bingham Pycnometer Method (D 1480 – 57 T)

This method describes two procedures for the measurement of the density of materials which are fluid at the desired test temperature. Its application is restricted to liquids of vapor pressures below 600 mm of mercury and viscosities below about 400 stokes at the test temperature. The method is designed for use at any temperature between 20 and 100 C. It may be used at higher temperatures; however, in this case the precision section does not apply.

Density and Specific Gravity of Hydrocarbon Liquids by Lipkin Bicapillary Viscous Oil Pycnometer (D 1481 – 57 T)

This method is intended for determining the density of oils more viscous than 15 centistokes at 20 C (68 F), and of viscous oils and melted waxes at elevated temperatures, but not at temperatures at which the sample would have a vapor pressure of 100 mm of mercury or above. Densities at 37.78 C (100 F) and 99 C (210 F) are particularly desired for use in converting the corresponding viscosities in stokes to viscosities in poises.

Blocking Point of Paraffin Wax (D 1465 – 57 T)

Electrical Insulating Materials (D-9)

Methods of Test for:

Set Time of Thermosetting Phenol Formaldehyde Varnishes (D 1482 – 57 T)

This test is intended to classify the curing characteristics of varnishes containing heat-reactive phenol formaldehyde resins. While it is intended specifically for laminating varnishes it may also be useful for evaluating other solubilized thermosetting phenol formaldehyde resins where satisfactory confirmatory data exist.

2,6 Ditertiary Butyl Para-Cresol in New Electrical Insulating Oils (D 1483 – 57 T)

The method provides a quantitative procedure for determining this widely used oxidation inhibitor, also called DBPC, in new electrical oils.

Rubber (D-11)

Methods of Test for:

Sampling and Sample Preparation of Synthetic Elastomers (Solid Styrene-Butadiene Copolymers) (D 1485 – 57 T)

These methods are also applicable to other synthetic elastomers. Two methods are provided for volatile matter sampling; Variables and Attributes. Variables refers to the sampling system used when all specimens are tested and acceptance is based upon the composite result. Attributes refers to the sampling system used when only the poorest appearing specimens are tested and acceptance is based on individual results.

Penetration of Hard Rubber by Type D Durometer (D 1484 – 57)

This method is a companion method to the present test for hardness of hard rubber in Method D 530 which uses the Rockwell hardness apparatus.

Soaps and Other Detergents (D-12)

Method of Test for:

Copper in Soaps and Soap Products (D 460 – 57 T)

This is the first photometric method prepared by Committee D-12. It covers a procedure for the determination of trace amounts of copper in soaps and soap products. This method is one of the early results of an intensive review of the Standard Methods of Sampling and Chemical Analysis of Soaps and Soap Products (D 460 – 54), which will result in a number of new and revised procedures.

Textiles (D-13)

Methods of Test for:

Thermal Transmittance of Textile Fabric and Batting Between Guarded Hot-Plate and Cool Atmosphere (D 1518 – 57 T)

This method is intended for use in determining over-all thermal transmission coefficients due to the combined action of conduction, convection, and radiation. It measures the time rate of heat transfer from a warm, dry, constant-temperature, horizontal, flat-plate up through a layer of the test material to a relatively calm, cool atmosphere.

Testing Tufted Pile Floor Coverings (D 1486 – 57 T)

These are the first ASTM methods for testing tufted pile floor coverings that have been prepared in response to a need resulting from the extensive use of tufted textile products. The methods provide procedures for determining length and width, weight, moisture content and regain, total thickness, back thickness, net pile thickness, and other construction features such as stitches and yarn ends per inch. Detailed procedures are provided for dissecting the pile floor covering and determining other characteristics such as tuft length and loop length.

Shrinkage in Laundering and Dimensional Restorability of Warp Knit Fabrics (D 1487 – 57 T)

This is the first in a series of ASTM methods for testing warp knit textiles which are commonly referred to as "tricot" fabrics. The method determines the total shrinkage in laundering (full change in dimensions with avoidance of any restorative force) and the dimensional restorability under a specified restorative force of warp knit fabrics of any fiber content. This method replaces the present shrinkage test for knit cotton fabrics (D 1231) and for knit rayon fabrics (D 1232).

Dimensional Change of Knit Fabrics (D 1470 – 57 T)

This method covers a test procedure for determining the total shrinkage in laundering (full change in dimensions with avoidance of any restorative force) of warp or circular knit fabrics. Three washing procedures are provided: (1) Class 3, a severe machine wash at 140 to 160 F, (2) Class 2, a mild machine wash at 100 F, and (3) Class 1, a hand wash.

Predicting Differential Dyeing Behavior of Cotton (D 1464 – 57 T)

Adhesives (D-14)

Methods of Test for:

Nonvolatile Content of Aqueous Adhesives (D 1489 – 57 T)

Due to the fact that the nonvolatile content of some adhesives will vary considerably with the best method used, these tests are designed to give reasonably uniform agreement among different laboratories for each of these several types of adhesives.

Amylaceous Matter in Adhesives (D 1488 – 57 T)

This test has been proposed to determine the presence of a starch-containing filler in adhesives in case some deleterious properties may result from its use.

Nonvolatile Content of Urea-Formaldehyde Resin Solutions (D 1490–57)

Industrial Aromatic Hydrocarbons (D-16)

Methods of Test for:

Solidification Points of Chemicals (D 1493 – 57 T)

For determining the solidification point of crude and refined chemicals such as benzene, naphthalene, phenol, quinoline, phthalic anhydride, and similar materials having solidification points between about 20 and 150 C.

Bromine Index of Aromatic Hydrocarbons by Coulometric Titration (D 1492 – 57 T)

Bromine Index of Aromatic Hydrocarbons by Potentiometric Titration (D 1491 – 57 T)

These methods are two different means of determining the amount of bromine reactive material and hydrocarbon products.

Industrial Water (D-19)

Methods of Test for:

Sampling Homogeneous Industrial Waste Water (D 1496 – 57 T)

These methods cover the sampling at atmospheric or higher pressures for physical and chemical tests. While it has not been possible to establish specific sampling methods that cover all details for all cases, definite principles have been established that are applicable in general and probably to most specific cases.

Iron in High-Purity Industrial Water (D 1497 – 57 T)

The increasing demands for very high-purity industrial water, including water used in nuclear power plants, have made necessary methods suitable for determining very low concentrations of certain constituents. This method covers the photometric determination of low concentrations of iron 200 parts per billion and under by measurement of the color developed with bathophenantholine.

Plastics (D-20)

Recommended Practice for:

Resistance of Plastics to Artificial Weathering Using Fluorescent Light and a Fog Chamber (D 1501 – 57 T)

This aging test is designed to simulate outdoor exposure conditions on a laboratory scale.

Method of Test for:

Transverse Load of Corrugated Reinforced Plastic Panels (D 1502 – 57 T)

This method covers a test for determining the ultimate transverse load of corrugated reinforced translucent building panels and has application, for example, in design for snow loading of plastic patio roofs.

Orientation Stress Release of Plastic Sheeting (D 1504 – 57 T)

Orientation stress or internal locked-in stress from the manufacturing process influences physical properties and therefore can be a useful criterion for specification purposes.

Measurement of the Density of Plastics by the Density-Gradient Technique (D 1505 – 57 T)

This method provides a means for rapidly determining the density of a plastic to a greater accuracy than has been heretofore possible. The density of a solid is a conveniently measurable property which is frequently useful as a means of following physical changes in a sample or as an indication of uniformity among samples.

Specifications for:

Extruded Cellulose Acetate Butyrate Pipe (D 1503–57 T)

Specifications are needed to control the quality of this pipe which has become a regular article of commerce. These specifications cover the requirements, dimensions, and tolerances of pipe extruded from cellulose acetate butyrate materials.

Carbon Black (D-24)

Methods of Test for:

Pellet Size Distribution of Carbon Black (D 1511 – 57 T)

This method describes the procedure for separating a pelleted carbon black sample into six portions depending upon the size of the pellets.

Attrition of Pelleted Carbon Black (D 1507 – 57 T)

This method describes a procedure for determining the amount of breakdown of carbon-black pellets which are subjected to severe mechanical work. Good mechanical stability is required of carbon blacks which are to be used in a bulk-handling system.

Sieve Residue from Carbon Black (D 1514 – 57 T)

This method describes a procedure for determining the amount of coke-like nondispersible material which may be present in carbon black.

Pour Density of Pelleted Carbon Black (D 1513 – 57 T)

The pour density of carbon black is related to the amount of pelleted black that can be stored in a given volume.

Fines Content of Pelleted Carbon Black (D 1508 – 57 T)

Fines or dust are important in the operation of bulk handling systems for carbon black since an excessive amount causes plug-ups. High fines content can also interfere in the smooth operation of internal mixers for rubber-black formulations.

Ash Content of Carbon Black (D 1506 – 57 T)

Inorganic ash in carbon black affects the cure-rate and moisture pickup of rubber-black formulations.

Heating Loss of Carbon Black (D 1509 – 57 T)

This method describes a procedure for determining the heating loss, primarily due to moisture, of carbon black. Moisture affects the cure-rate of some rubber-black formulations.

pH of Carbon Black (D 1512 – 57 T)

Acidic carbon blacks retard the cure-rate of rubber-black mixtures.

Iodine Adsorption Number of Carbon Black (D 1510 – 57 T)

The amount of iodine adsorbed by carbon blacks has long been used as a measure of the surface areas. Blacks of high surface area are more reinforcing in rubber than are coarser carbons.

Methods of Testing (E-1)

Methods of Test for:

Inspection and Verification of Hydrometers (E 126 – 57 T)

These methods apply to glass hydrometers of the constant-mass, variable-displacement type. They are intended to apply not only to ASTM hydrometers as covered by specifications E 100, but are also applicable to testing of glass hydrometers in general.

Maximum Pore Diameter and Permeability of Rigid Porous Filters for Laboratory Use (E 128 – 57 T)

The procedures are applicable to filters made of sintered glass, ceramic, metal, or plastic. This method establishes a uniform designation for maximum pore diameter and also provides a means of detecting and measuring changes which occur through continued use.

Specifications for:

Gravity-Convection and Forced-Ventilation Laboratory Ovens (E 127 – 57 T)

These specifications cover the performance requirements for general purpose air ovens ordinarily used in testing operations. They are applicable to ovens which are designed to operate over all or part of the temperature range from 20 C above ambient temperature to 300 C, and which have a testing chamber of not more than 25 cu ft. These specifications are a companion standard to the present ASTM Specification for Cell-Type Oven with Controlled Rates of Ventilation (E 95 – 52 T).

Emission Spectroscopy (E-2)

Methods for:

Spectrochemical Analysis of Nickel Alloys by the Powder–D-C Arc Technique (E 129 – 57 T)

This method is intended particularly for inspection testing of nickel-alloy thermionic cathodes, but is equally applicable to any nickel alloy where the nickel content is greater than 98 per cent, provided at least 50 mg of sample is available. The method permits the rapid determination of very small percentages of a number of elements, with good precision.

Designation of Shapes and Sizes of Preformed Graphite Electrodes (E 130 – 57 T)

This practice is intended to simplify the description of electrodes in methods for spectrochemical analysis by designating shapes and sizes of graphite electrodes considered adequate to satisfy most needs. While not intended to preclude other special shapes and sizes that a user may consider

desirable, this practice should provide a basis for some degree of standardization of shapes and sizes of electrodes most generally and readily available.

Absorption Spectroscopy (E-13)

Definitions of:

Terms and Symbols Relating to Absorption Spectroscopy (E 131 – 57 T)

These definitions cover the most important terms in absorption spectroscopy and are intended to provide a basis for uniform nomenclature in this field. Additional terms will be added as definitions are agreed upon.

Electronic Materials (F-1)

Specifications for:

Clear Nickel-Clad and Nickel-Plated Steel Strip for Electron Tubes (F 1 – 57 T)

Aluminum-Clad Steel Strip and Nickel-Steel-Aluminum Composite Strip for Electron Tubes (F 2 – 57 T)

Clear Nickel Strip for Electron Tubes (F 3 – 57 T)

Carbonized Nickel Strip and Carbonized Nickel-Plated and Nickel-Clad Steel Strip for Electron Tubes (F 4 – 57 T)

These are the first specifications developed by Committee F-1 covering different types of strip materials for use in electron tubes especially for anodes (plates). These specifications fill a long-standing need in the industry.

Leather (Joint ALCA-ASTM)

Methods of Test for:

Area of Leather (D 1515 – 57 T)

Because of the irregular shapes of hides it is necessary to have a standardized method for estimating the area, which this test provides.

Width of Leather (D 1516 – 57 T)

This method provides a procedure for determining width of physical test specimens as well as regularly shaped units and pieces of all types of leather.

Definitions:

Terms Relating to Leather (D 1517 – 57 T)

These definitions are in two groups: (*a*) terms applicable to sampling leather, and (*b*) general terms relating to leather. Terms adequately described in unabridged dictionaries are not included.

Actions on Standards by the Administrative Committee on Standards

The Administrative Committee on Standards is empowered to pass upon proposed new tentatives and revisions of existing tentatives and standards offered between Annual Meetings of the Society. On the dates indicated below, the Standards Committee took the following actions:

Road and Paving Materials

Tentative Method of Test for Moisture or Volatile Distillates in Bituminous Mixtures (D 1461 - 57 T) (Approved May 15, 1957)

New Tentative.—This method, identical to the Standard T 110 - 42 of the American Association of State Highway Officials, is felt by Committee D-4 on Road and Paving Materials to be more suitable for particular use with compressed bituminous mixtures than the existing Tentative Method of Test for Water in Petroleum Products and Other Bituminous Materials (D 95).

Paint, Varnish, Lacquer, and Related Products

Sampling Liquid Oils and Fatty Acids Commonly Used in Paints, Varnishes, and Related Materials (D 1466 - 57 T) (Approved May 23, 1957)

New Tentative.—The paint, varnish, and resin industry, and other industries using oils and fatty acids need a method for sampling shipments or stocks of these major raw materials. This method, which was prepared by Subcommittee II on Drying Oils of Committee D-1 on Paints makes proper provision for the physical characteristics of vegetable and marine oils such as solidification, presence of suspended matter, foots, etc., to insure representative samples.

Tentative Specifications for Refined Soybean Oil (D 1462 - 57 T) (Approved May 23, 1957)

New Tentative.—Refined soybean oil is a grade of oil which is becoming increasingly important in the paint, varnish, and resin industries.

Tentative Method of Test for Effect of Household Staining Agents on Applied Nitrocellulose Clear and Pigmented Finishes (D 1308-54 T) (Approved May 23, 1957)

Revision.—The scope of this method is enlarged to include organic finishes other than clear and pigmented nitrocellulose and the title is accordingly changed to Tentative Method of Test for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

Tentative Method of Test for Permanganate Time of Lacquer Solvents and Diluents (D 1363 - 55 T) (Approved May 23, 1957)

Revision.—Color of the uranyl nitrate-cobaltous chloride color standard is adjusted to conform more nearly to the definition of the color end point.

Tentative Recommended Practice for Operating Light-and-Water-Exposure Apparatus (Carbon-Type Arc) for Testing Paint, Varnish, Lacquer, and Related Products (D 822 – 46 T) (Approved June 3, 1957)

Standard Method of Chemical Analysis of Dry Mercuric Oxide (D 283 – 33) Methods of Testing Varnishes (D 154 – 53) (Approved June 3, 1957)

Revision.—These methods are modernized to conform to the recently revised Recommended Practice for Operation of Light-and-Water Exposure Apparatus (Carbon-Type Arc) for Artificial Weathering Test (E 42). Method D 284 reverts to tentative.

Revision of Tentative Revision.—The present complicated procedure for determination of combined mercuric mercury is replaced by a very simple direct titration with standardized ammonium thiocyanate solution to determine total mercury. The revision is based on the procedure used in Military Specification for Mercuric Oxide MIL – M – 15177A.

Filler Metal

Tentative Specification for Copper and Copper Alloy Welding Rods (B 259-57 T) (Approved June 3, 1957)

Revision.—Two of the copper-zinc welding rods in this specification (RBCuZn-A and RBC-Zn-D) have been made identical to similar materials in the Specification for Brazing Filler Metals (B 260). This simplifies the selection and storage of these filler metals. In addition, an aluminum-bronze (RCuAl-A1) and a manganese-bronze (RCuZn-B) have been eliminated from the specification since they are no longer of significance in the field. A new low fuming bronze has been added to replace the manganese-bronze.

Specification for Copper and Copper Alloy Welding Electrodes (B 225-57 T) (Approved June 3, 1957)

Revision.—For the first time two types of stranded aluminum-bronze electrodes (ECuA1-A2 and ECuAl-B) are covered by a specification. In addition, one type of aluminum-bronze electrode (ECuAl-A2) for use with the submerged arc process, is standardized.

For both specifications, chemical requirements have been brought up to date and more explanatory material has been added to the Appendix for certain of the filler metals.

NEW ASTM PUBLICATIONS

The ASTM publications described in these columns have just come off press, and may be obtained from Society Headquarters, 1916 Race St., Philadelphia, Pa.

Symposium on Radiation Effects on Materials

SPONSORED jointly by ASTM and the Atomic Industrial Forum, this symposium, held at the Los Angeles meeting in 1956, is the first of a projected series designed to make available the tremendous amount of new and previously classified information on irradiated materials.

The papers are divided in three parts: (1) theory of radiation, (2) radiation facilities and mechanics of testing, (3) experimental tests and results on fuel and graphite materials and structural materials, including organics.

The data and evaluations are made as a contribution to the understanding of existing code and specification values as they apply to nuclear reactor structures and components. Known properties of materials must be evaluated in the light of actual reactor operating conditions. By adapting and interpreting the vast amount of data on unirradiated materials, cautious extrapolation is allowable within the limits of experimental error.

Titles of papers and their authors are as follows:

Introduction—*D. O. Leeser and C. C. Woolsey*

Theory

Displaced Atoms in Solids—Comparison Between Theory and Experiment—*G. J. Dienes*

Radiation Facilities and Mechanics of Testing

A Radiation-Effects Program—*J. E. Whitney, E. M. Chandler, J. E. Gates, and G. D. Calkins*

The Mechanics of Testing Irradiated Materials—*R. Berggren, C. Dismuke, M. J. Feldman, and J. C. Wilson*

Problems of Dosimetry as Applied to Radiation Effects Studies—*C. H. Collins and V. P. Calkins*

Westinghouse Testing Reactor—*A. W. De Agazio*

Experimental: Fuel and Graphite Materials

Survey of Radiation Effects on Fuel Materials—*Dwain Bowen*

Influence of Heat Treatment in Irradiation-Induced Dimensional Changes in Some Uranium-Zirconium Alloys—*J. H. Kittel, S. H. Paine, and H. H. Chiswik*

Self-Limitation of Radiation Effects on Graphite—*R. L. Carter*

Experimental: Structural Materials Including Organics

Survey of the Effects of Neutron Bombardment on Structural Materials—*L. Castleman*

A Summary of the Effect of Irradiation on Some Plastics and Elastomers—*Oscar Sisman and C. D. Bopp*

The Problem of Establishing Specifications for Irradiated Organic Materials—*Oscar Sisman*

Effect of Irradiation on the Notched-Bar Impact Properties of Some Plain Carbon Steels—*D. O. Lesser and C. J. Deily*

Radiation Effects on Welds and Notches in Plain Carbon Steels, Stainless Steels, and Non-Ferrous Alloys—*D. O. Leeser*

Fast Neutron Effects on Tensile and Hardness Properties of Type 347 Stainless Steel—*W. F. Murphy and S. H. Paine*

These papers, together with individual discussion total 196 pages. *Special Technical Publication 208.* Price: $4.75; to members, $3.50.

Symposium on Vapor Phase Oxidation of Gasoline

TO JUDGE by current motor fuel advertising, one could easily conclude that octane number is the only thing that makes the wheels go around. The fact is that the successful operation of the world's 63,000,000 cars, trucks, and tractors is predicated on the rapid evaporation of the gasoline with air in the induction system, aided by heat at the manifold. This evaporation must be carried out without leaving an appreciable residue on the walls of the system.

It is a tribute to the petroleum refining industry that it is annually producing 50,000,000,000 gal of gasoline which have to pass through this critical zone where evaporation takes place without leaving a significant amount of residue.

Continual vigilance is needed, however, to maintain this quality of performance, and the need for more study is shown in the inadequacy of existing testing methods under the extreme conditions imposed by military operations.

This symposium, held at the ASTM Second Pacific Area National Meeting in September, 1956, was developed by the Technical Committee on Gasoline of ASTM Committee D-2 on Petroleum Products and Lubricants as a review of several valuable research project is then field of oxidation behavior of gasolines in fuel induction systems.

Titles and authors of the papers are as follows:

Fuel Factors Influencing Intake System Deposition—*C. R. Bauer and H. J. Scheule*

Induction System Gum—Engine Versus Bench Test—*J. L. Keller and F. S. Liggett*

Effect of Fuel Composition upon Intake Valve Deposit-Forming Characteristics—*A. V. Cabal and J. Capowski*

Induction System Reactions—Liquid or Vapor?—*A. C. Nixon, H. B. Minor, and T. P. Rudy*

These papers together with discussion total 72 pages. *Special Technical Publication 202.* Price: $2.50 to members, $1.85.

Symposium on the Full-Scale Testing of House Structures

HOUSE design and construction have been receiving increased attention in recent years as the volume of housing through the world, and particularly in North America, has rapidly increased and as new systems of construction have been introduced. The growing use of prefabrication has served still further to direct the attention of architects and engineers to the development of rational methods for the structural design of house frames. Correspondingly, the need to reduce the size of members and details of standard house designs to the minimum consistent with safety and convenience—the search for economy—has further stimulated research into the strength of house frames.

ASTM Committee E-6 on Methods of Testing Building Construction has a vital interest in these problems since it deals not only with development of methods and specifications for building components but with test methods for complete structures. Committee D-7 on Wood has a similar interest when structures are made of wood as is so often the case in North America.

It was appropriate that these two committees should join in the sponsorship of this symposium at the Second Pacific Area Meeting in September, 1956. The publication of this symposium is probably the first of such full-scale structural tests of completed structures. Titles and authors of the five papers, together with discussion, are as follows:

Introduction—*Robert F. Leggett*

Rigidity and Strength of Houses Built of Plywood Stressed-Cover Panels—*R. F. Luxford and E. C. O. Erickson*

NAVCERELAB Facilities for Evaluating Prefabricated Buildings—*J. E. Dykins*
Full-Scale Testing of Prefabricated Military Buildings—*R. F. Bartelmes* Structural Test of a House Under Simulated Wind and Snow Loads—*D. B. Dorey and W. R. Schriever*
Full-Scale Tests of Pre-Cast Multi-Story Flat Construction—*A. J. Francis, W. P. Brown, and S. Aroni*

Special Technical Publication No. 210. 67 pages. Price: \$2.50; to members, \$1.85.

Symposium on Industrial Water and Industrial Waste Water

ALTHOUGH water for industrial use and for the disposal of wastes has always been important, the rapid growth of industry and technological advances in the past few decades have made this one of industry's foremost problems.

This symposium, developed by ASTM Committee D-19 on Industrial Water and held at the ASTM Los Angeles meeting in 1956, marks an important contribution to the solution of some of the problems in the field. Included in this publication is Claude K. Rice's Industrial Water Luncheon address on the relations of the public, government, and industry in the measurement and abatement of stream pollution.

A complete list of the papers which appear, with their discussions, follows:

Three Is a Vital Number—*C. K. Rice*
Committee D-19: The First Quarter Century—*R. C. Adams*
Industrial Waste Problems in Southern California—*T. C. Wilson*
Water Pollution Control in the Los Angeles Area—*C. B. Johnston*
Sea Water Purification—*O. M. Elliott*
The Use of Organic Flocculants and Flocculating Aids in the Treatment of Industrial Water and Industrial Waste Water—*J. K. Rice*

Special Technical Publication No. 207. 52 pages. Price: \$2; to members, \$1.50.

ASTM Standards for Bituminous Materials for Highway Construction, Waterproofing, and Roofing

INCLUDES 112 standards pertaining to bituminous materials developed by Committees D-4 on Road and Paving Materials and D-8 on Bituminous Waterproofing and Roofing Materials; also, standards for creosote materials under the jurisdiction of Committee D-7 on Wood.

Contents cover: methods of testing; specifications for highway construction materials; waterproofing and roofing materials; creosote; sieves; thermometers; recommended practices; and definitions.

460 pages; Price: \$4.75; to members, \$3.50.

36 New Sustaining Members Strengthen Society

The following have joined the Society as Sustaining Members since January 1:

Eastern States Petroleum Co., Inc.
Litton Industries
Midwest Job Galvanizers Assn.
Tele-Dynamics, Inc.

The following companies have authorized *transfer* of their company membership to Sustaining:

American Metal Co., Ltd.
American Potash & Chemical Corp.
American Window Glass Co.
Archer-Daniels-Midland Co.
Atlas Powder Co.
C. F. Braun and Co.
Canada Wire and Cable Co., Ltd.
Carbide and Carbon Chemicals Co.
Columbia Steel & Shafting Co. (Summerill Tubing Co. Div.)
Commercial Solvents Corp.
Darling Valve & Manufacturing Co.
Driver-Harris Co.
Electric Hose and Rubber Co.
Ford Motor Company of Canada, Ltd.
General Cable Corp.
General Radio Co.
Handy & Harman
Holyoke Wire and Cable Corp.
I-T-E Circuit Breaker Co.
Kennecott Copper Corp.
Kuhlman Electric Co.
National Petro-Chemicals Corp.
Neptune Meter Co.
Nichols Wire and Aluminum Co.
Nopco Chemical Co.
Northwestern Steel & Wire Co.
Orenda Engines Ltd.
Charles Pfizer and Co., Inc.
Portland Gas & Coke Co.
Triangle Conduit and Cable Co., Inc.
Underwriters' Laboratories, Inc.
Union Wire Rope Corp.

The Directors appreciate this increased support of the work of the Society. The Membership Committee will be glad to send information on "Significant Aspects of ASTM Sustaining Membership" to other companies.

Citations for Quality of Presentation

R. H. Brink R. M. MacIntosh K. A. Kraus

APART from maintaining the technical quality of all the papers presented at meetings of the Society, the Committee on Papers and Publications is also interested in having these papers well presented. Much emphasis is being placed currently on the importance of communication. This is found to be particularly significant in conveying ideas or concepts for dealing in technical developments.

With this in mind and also with the view of improving the interest at technical sessions the plan was instituted of grading the character of presentation on the part of the authors. Reporters were assigned to the task of reporting in detail on the character of presentation of all of the papers at the 1956 Annual Meeting. Based upon these reports the three outstanding presentations are selected and recognition is being accorded these three individuals:

R. H. Brink, Bureau of Public Roads, for "Studies Relating to the Testing of Fly Ash for Use in Concree."
Robert M. MacIntosh, Tin Research Inst., for "Corrosive Fluxes—Their Role in Soldering."
Kurt A. Kraus, Oak Ridge Laboratory, for "Metal Separation by Anion Exchange."

Magnetic Materials Conference

A CONFERENCE on Magnetism and Magnetic Materials will be held in Washington, D. C., on November 18, 19, and 20, 1957, by the American Institute of Electrical Engineers in cooperation with the American Physical Society, the American Institute of Mining and Metallurgical Engineers, the Institute of Radio Engineers, and the Office of Naval Research. For further details, write: L. R. Maxwell, U. S. Naval Ordnance Lab., White Oak, Silver Spring, Md.

ACR Notes

Forgetting the Important

By BRUCE W. GONSER[1]

"We are so preoccupied with the urgent that we forget the important."

This statement, made at a recent meeting of the National Research Council's Division of Engineering and Industrial Research, certainly is food for thought. What a preacher couldn't do with that as a text! In fact, overlooking the important because of the demands of the urgent is probably all too common in every occupation.

One wonders how many traffic accidents happen daily because people are in a big rush, or think they are. Even getting into a car from the curb side seems to be a lost art. Taking chances, disregarding precautions, too much speed to save a minute that is wasted later, as every safety director knows, may be a daily urgency and also a disastrous way. Possibly the important thing is to live a while and be happier.

In this same connection, did you ever take a short-cut to save a few minutes and end up in a blind alley—or worse? The old adage of "Haste makes waste" still bears repeating occasionally. This is not said to discourage the spirit of adventure and of trying the unusual. That is most commendable, but if something is really important, the sense of urgency should be tempered with a bit of caution.

Time for Wondering

One wonders, also, how many executives become so lost in the maze of day-to-day emergencies, quick discussions, and constant callers that there is no time for constructive planning ahead. A desk piled high with unanswered correspondence and reports to be read naturally gives a feeling of urgency and all too often of tension. Blessed is he who can go through such a daily series of urgencies without developing ulcers or losing his happy home life. It pays, occasionally, to sit back a moment and wonder just what things are important.

Perhaps one of the best illustrations of an attempt to divorce the urgent from the important is the plan of a military agency to use civilian specialists to aid in important long-range planning. To call a meeting in Washington for a day or two and try to handle such planning by correspondence has given only limited results. But, getting the civilians entirely away from their jobs for at least a week or so, where they forget their day-to-day urgent responsibilities and really concentrate on the important problem, is said to work wonders. It undoubtedly does. As on a vacation trip, it usually takes a day or two, at least, to get into the spirit of a different way of living and thinking. For planning in a less familiar field, where many complex factors must be considered, it is obvious that the cobwebs of worry about the regular job must first be cleared away.

Research is Long Range

What has all this to do with research in general and ASTM in particular? Well, in research of all places, one has to keep constantly in mind the broad, important objectives ahead. Side issues are interesting and a certain amount of rambling is inevitable and often desirable, but this can all too easily be carried to an extreme. We can all point to many examples of weeks, or even months, of labor spent to perfect a piece of hastily devised equipment or a procedure that did not, and could not, reach the really important objective. Then, there is the data accumulator, who becomes so imbued with the spirit and urgency of collecting, that he forgets what the data are for. Also, there is the well-traveled path of establishing a research department with lofty ideas of devising new products and leading the company to lush green pastures. Only, a few years later, the management finds that the hard-pressed staff has been so busy working out urgent plant operating troubles, that they never have had a chance to even get started on something new.

The Important in ASTM

In the ASTM, also, there is plenty of opportunity for the long-range *important* to get mixed up with the immediate *urgent*. It is such a complex organization with interests along an extremely wide field of activity. A marvelous thing about it is that it works so well. An Atlantic City Annual Meeting is like a 40-ring circus, if such a far-fetched comparison can be made. The number of meetings of committees, subcommittees, task groups, special committees, administrative committees, and technical sessions going on simultaneously is amazing, if not downright confusing. There is reason for all of them, of course.

In this beehive of activity, most of the work, by necessity, must be done by men having urgent business of their own to tend. In fact, it is a real tribute to the importance of ASTM that so many people will devote their valuable time to its manifold activities. They must, from time to time, have to make decisions on what Society items are more important than their own business urgencies.

The work of ASTM is built on cooperation and group effort. In its aims to effect orderliness, simplification, standardization, and a sound technical basis for judging or describing materials, the opinions and judgment of many are sifted down to a conclusive answer—at least temporarily, since improvement is nearly always possible later. Small points may be debated endlessly. Important conclusions may be passed over lightly, usually from lack of positive information. Research and experimentation to establish facts come into the picture, although usually not as much as desired to establish facts rather than opinions. In all this, there is constantly the need to ask, "Is this really important?" "Am I honestly submerging my personal interest for the good of the whole group?" "Is this item truly urgent when the important thing is to arrive at a logical conclusion or get the facts?"

It is not the purpose of this discussion to point out specific applications where the important aims are lost in the struggle with urgent impediments. (That probably should be the important thesis, but I'm too busy with other things just now!) Rather, it is to call attention to the fact that the important and the urgent are not necessarily synonymous in ASTM work, as in any other phase of living. Then, we can all apply this thought to the situation that fits best.

[1] Technical director, Battelle Memorial Institute.

ASTM Bulletin

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NINETEEN-SIXTEEN
RACE STREET
PHILADELPHIA 3, PENNA.

1958 Annual Meeting in Boston to Feature Outstanding Lectures

Clyde Williams, Battelle Memorial Inst., and Elmer Pehrson, Bureau of Mines, to Speak

THE 1958 Annual Meeting of the Society to be held in Boston the week of June 22 will feature two outstanding lectures. The H. W. Gillett Memorial Lecture will be given by Clyde Williams, president of Battelle Memorial Inst., on the subject "Super Alloys for the Jet Age." It is fitting that Dr. Williams should deliver this because of his many years of association with Dr. Gillett and also because of his prominence and that of his organization in the area to be covered. Among other things, he will give attention to our potential resources of the metals and alloys on which it is probable our future developments depend.

The Board of Directors is also pleased to announce that Elmer W. Pehrson, chief, foreign operations, U. S. Bureau of Mines, will deliver the Marburg Lecture covering salient aspects of resources of many important materials. The two lecturers will coordinate their talks.

Mr. Pehrson, in 1956, made a round-the-world trip, flying almost 40,000 miles and has been in constant touch with this matter of industrial raw materials. This year he is delivering lectures in Sweden and Germany. A longtime associate of ASTM Past-President A. C. Fieldner, Mr. Pehrson will bring to the meeting an authoritative background.

Further details concerning the lecturers and the lectures will appear in the BULLETIN and in connection with news of the Boston meeting. Plan to attend both of these outstanding sessions to be scheduled very probably on Tuesday and Wednesday of that week.

Schedule of ASTM Meetings

This gives the latest information available at ASTM Headquarters. Direct mail notices of all district and committee meetings customarily distributed by the officers of the respective groups should be the final source of information on dates and location of meetings. This schedule does not attempt to list all meetings of smaller sections and subgroups.

Date	Group	Place
Oct. 3–4	Committee C-8 on Refractories	Bedford, Pa. (Bedford Springs Hotel)
Oct. 6–10	Committee D-2 on Petroleum Products and Lubricants	Washington, D. C. (Sheraton Park Hotel)
Oct. 6–10	Joint ASTM-TAPPI Committee on Petroleum Wax	Washington, D. C. (Sheraton Park Hotel)
Oct. 7–10	Committee C-16 on Thermal Insulating Materials	Ottawa, Ontario (Chateau Laurier)
Oct. 10–11	Committee E-6 on Methods of Testing Building Constructions	Ottawa, Ontario (National Research Council)
Oct. 10–11	Committee C-20 on Acoustical Materials	Ottawa, Ontario (National Research Council)
Oct. 9–10	Committee B-5 on Copper and Copper Alloys	Boston, Mass. (Statler Hotel)
Oct. 15–18	Committee D-13 on Textile Materials	New York, N. Y. (McAlpin Hotel)
Oct. 30–31	Committee D-10 on Shipping Containers	Atlantic City, N. J. (Claridge Hotel)
Oct. 31–Nov. 1	Committee D-14 on Adhesives	Philadelphia, Pa. (Sheraton Hotel)

SPECIAL MEETING—WEST COAST, 1959

THE ASTM Board of Directors, after consultation with the West Coast Districts, has decided to hold the Third Pacific Area National Meeting in 1959 in San Francisco, throughout the week beginning September 14. The Sheraton-Palace will be the headquarters hotel, but others will cooperate, especially for sleeping accommodations.

The Northern California members made a strong plea that the meeting be held in this area, and this seemed quite logical to the Board, particularly because of the constantly increasing industry around the bay area.

Further announcement will be made, including the personnel of a General Committee on Arrangements which is now being selected.

There has always been a very loyal group of members and committee members in Northern California, and the committee will undoubtedly make every effort to have this meeting surpass the two previously held on the coast—1949, San Francisco; 1956, Los Angeles.

Plan now to attend this meeting.

ASTM Standards in Free China

AN INTERESTING glimpse into the heroic efforts of Oriental nations to bring themselves abreast of Western technological progress is provided in a pamphlet published on the 10th Anniversary of Nationalist China's National Bureau of Standards.

That ASTM has played an important part in this effort is indicated by the statement in the report showing that more standards have been received from ASTM than any other single agency in the free world with whom the Formosans exchange information.

The Society has reason to be proud of its contributions to the industrialized nations of the West, but most of its members would probably feel an extra satisfaction that its work is available to assist Eastern peoples to a share in the material improvements in human existence that industrialization brings.

To the Editor

DEAR SIR:

D. K. Crampton, in his 1956 H. W. Gillett Memorial Lecture, *Structural Chemistry of Metallurgy of Copper,* published by the American Society for Testing Materials in January, 1957, comments on certain work of mine on localized pitting attack on copper in tap waters. After referring to the evidence that I have produced for the existence of a natural inhibitor in many waters, he rightly observes that the natural inhibitor does not offer a general solution to the problem since it has not been identified and consequently cannot be added to the water. He goes on to point out that pitting corrosion commonly occurs only in some pipes, others handling the same water being unaffected, and seems to imply that this aspect of the problem has been ignored. In fact one of the two papers[1] quoted by Crampton in connection with the natural inhibitor is primarily concerned with showing that this difference of behavior between tubes is generally due to differences in the surface condition of the tubes concerned, a difference which can readily exist between adjacent lengths of tube in the same system. Further evidence of this was presented in a British Non-Ferrous Metals Research Assn. Miscellaneous Publication 420 in 1954. The conclusions reached in these papers are, briefly, as follows:

Pitting corrosion of copper water pipes takes place only if the inner surface of the tube is covered by a reasonably continuous film or scale which is more noble than the copper beneath. A few waters, particularly moorland surface waters, deposit a scale rich in manganese dioxide in the hottest parts of a water system and this scale can lead to pitting corrosion of the pipes concerned. Most waters, however, do not lay down noble scales and pitting corrosion occurring in these is nearly always due to the presence of films of carbon or thin continuous scales of glassy cuprous oxide formed in the tubes during manufacture. Carbon films can be formed by th breakdown of residual drawing lubricant during bright annealing of the tubes; the dangerous type of cuprous oxide scale is formed during annealing if very slightly oxidizing conditions exist within the tube. In the case of both carbon films and oxide scales the total amount of carbon or oxide present is less significant than the continuity of the film or scale which provides the large cathodic surface at small pores or cracks in which pitting of the underlying copper takes place.

It will be clear that if tubes containing the dangerous type of carbon film or oxide scale are installed in waters containing natural inhibitor, no corrosion will occur. In waters free from the inhibitor, however, such tubes are likely to suffer localized pitting whereas internally clean tubes installed in the same water and in the same system will suffer no corrosion.

As a result of the work of the BNF-MRA the importance of carbon films and oxide scales in copper water pipes has been widely recognized by the British tube making industry and precautions are now taken to minimize the likelihood of producing tubes containing either.

Very truly yours,

HECTOR S. CAMPBELL
Head, Corrosion Section, British Non-Ferrous Metals Research Assn.

[1] H. S. Campbell, "Pitting Corrosion in Copper Water Pipes Caused by Films of Carbonaceous Material Produced During Manufacture," *Journal*, Inst. Metals, Vol. 77, p. 345 (1950).

Detroit District Honors Students

THE DETROIT District Council presented student membership awards to 12 students from three universities on May 9 at a dinner meeting at the Engineering Society of Detroit.

ASTM Director J. M. Campbell presented the awards, following a brief talk about the role young engineers will need to play in industry and how important they will find standardization, testing, and quality control in the mass production industries. He urged them to give careful attention to their professional future and to enter their first employment with a professional attitude of doing the job in the same manner they would do it if the company were their own.

Students receiving awards from Junior engineering classes were Glen C. Smith, and Henry Banch, University of Michigan; Edward Coleman, Charles Olmstead, and David Petrillo, Wayne State University; and Donald J. Malaker and Michael F. DeMaioribus, University of Detroit. Senior engineering students receiving awards for the second time were Arnold M. Ruskin, and Peter Washabaugh, University of Michigan; Robert Lankau, Wayne State University; and Charles N. Rollinger, and Gerald M. Bookmyer, University of Detroit.

The meeting was concluded with a motion picture on "Engineering America."

ASTM Director J. M. Campbell presenting student membership awards to students in the Detroit District. Left to right, Edward Coleman, David Petrillo, Robert Lankau, Gerald Bookmyer, Mr. Campbell; Charles Olmstead, Donald Malaker, Charles Rollinger, and Michael DeMaioribus.

EDITORIAL: *Comparing Data on Materials Properties*

EDITOR'S NOTE.—An editorial by Arthur M. Merrill of particular significance to ASTM members appeared in the October, 1956, issue of *Plastics Technology* and is reprinted here with permission together with a letter written to Mr. Merrill by Frank W. Reinhart, Chairman of ASTM Committee D-20 on Plastics.

In our editorial series of a few months ago on "Sharing Industry Responsibilities," brief mention was made of the fact that much of the property data furnished by the suppliers on their materials cannot be compared because of differing test units and conditions. This is a subject worthy of further elaboration.

From the technical viewpoint, there is no reason why data on tensile strength, for example, cannot be reported by all suppliers in pounds per square inch at a specified temperature or range of temperatures. Actually, this is a simplified example because all suppliers do report tensile data in psi at room temperature and also at one or two other temperatures. The reported non-room temperatures are rarely identical between suppliers and materials.

In his Guest Editorial in our March issue, R. A. Rybak reported on his findings for impact strength data on various thermoplastics, as taken from physical data sheets published by their suppliers. He noted that "Charpy impacts are reported in four instances; two being in foot-pounds per cubic inch, the other two in foot-pounds per inch of width, and the results are obtained at various temperatures for unnotched and molded-notch specimens. Izod impacts are reported in 22 instances, but the results are given in foot-pounds, foot-pounds per inch of notch, and foot-pounds per inch of width; specimens are unnotched, notched, or have molded notches; notches are standard, gate-end, and dead-end types; tests are at room and low temperatures; and specimen sizes vary." This is standardization?

Rybak pointed out that "the inability to make any sort of comparison of materials on the basis of 'impact' strength data offered is self-explanatory. Other test methods, such as for hardness, heat distortion temperature, etc., also have been noted to vary from one material manufacturer to another."

Now, is this lack of uniformity of data deliberate, unintentional, or a combination of both? This question must be considered within the framework of standardization work by ASTM that has provided standard test methods for obtaining reproducible, comparable data on most physical properties of materials.

The point might be raised that the standard test method may require apparatus differing from that already in the supplier's laboratory. This is a negligible objection, however, since the cost of buying the "standard test apparatus" can be only a minor item in the supplier's over-all operating expense.

The only logical reason for existence of such non-uniform property data is that it permits a supplier to conceal or camouflage the fact that his material is inferior to another material in a certain property.

Unless these property data differences can be detected and compensated for by the users of the material, this "technical dishonesty" can only result in products that are not properly engineered for their applications. Then, both suppliers and processors must suffer.

ARTHUR M. MERRILL, *Editor*
Plastics Technology

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Dear Mr. Merrill:

Your editorial in the October, 1956, issue of *Plastics Technology* is very interesting and timely. Much of the confusion on reporting property information on plastics would disappear if (1) all those in the industry would read and use the report section of the ASTM methods they reference and (2) those who find defects in the methods would do a little work and help revise them.

ASTM Committee D-20 on Plastics welcomes suggestions concerning improvements in their methods of test and specifications. All will be given serious consideration. However, those who make suggestions should be willing to work on the problems that interest them. Progress can only be made on each problem when there are three or more individuals sufficiently interested to do more than talk. It is very easy to point at problems. It is sometimes very difficult to solve some problems. We need and welcome members who are sufficiently interested to work.

It is amazing to me at times to receive inquiries from technical personnel of industrial concerns, research institutes, and universities asking some simple questions that are clearly answered in current ASTM and Federal test methods. Either they are unaware of the pertinent literature in their field, are too lazy to read the methods, or do not understand what they read.

It is sometimes apparent that reports containing garbled data were carelessly written or were written by advertising or sales personnel with little knowledge or interest in scientific accuracy.

One psychological factor that should be considered is the belief among many people that because a value for a certain property of X's material is higher or lower than Y's material that X's material is better than Y's material. This is not necessarily true. A material cannot be categorically described as superior or inferior to another on the basis of property values alone. Specific property values for one material may be higher or lower numerically than that of another, but superiority or inferiority can be assessed only on the basis of a particular application. For example, one application may require a material with a high tensile elongation, whereas for another, a material with a low tensile elongation would be more satisfactory. Also, a relatively low-tensile-strength asphalt-treated paper and higher-tensile-strength polyethylene film are both suitable for ground covers and internal wall insulation in buildings. It is evident that tensile strength must be interpreted in a new light to resolve this apparent anomaly. Such an interpretation is not difficult to develop. It is evident that materials for a given application must be selected on the basis of the relation of property values to the service conditions involved and the design of the item.

Although the conclusion given in your editorial may be considered harsh, it is one that must be given serious consideration in addition to those I have given above. The plastics industry would be in a sounder position if standardization were given more attention and placed on the highest technical level by more of those working in and concerned with the industry.

Very truly yours,
FRANK W. REINHART, *Chairman*
ASTM Committee D-20 on Plastics

Summary of Proceedings and Letter Ballot

THE Summary of Proceedings of the Annual Meeting, setting forth the actions taken at the meeting will shortly be placed in the mails to all members in good standing. It will be accompanied by a letter on all recommendations calling for formal adoption as standard. The ballot is to be canvassed September 12.

Technical Committee Notes

Natural Building Stones

Specification for Roofing Slate Completed

A NEW specification for roofing slate, approved by Committee C-18, is considered to represent the first specification in the field of building stones which has been based on the quality of the material. All ASTM specifications are based on quality, as determined by test methods covering the physical and chemical properties of the material. The new specification, which was presented to the Society at the 1957 Annual Meeting, includes three grades based on length of service expected, namely, 75 to 100 years, 40 to 75 years, and 20 to 40 years. The physical requirements include limits on modulus of rupture, absorption, and depth of softening.

The committee, at its meeting in Washington, D. C., on April 16, also recommended for publication as information only a second specification covering the selection, sampling, and testing of granite for specific construction uses. For the first time physical requirements are proposed for various uses, both from an engineering and an architectural standpoint, and with life expectancies of less than and more than 50 years. A preliminary draft for a specification for marble has been prepared for further review.

The types of finishes for building stones was discussed with the conclusion that it is a proper function of the committee to develop standards in this field. A task group was authorized to study all aspects of finishes and wearing processes.

Structural Sandwich Construction

Core Test Methods Completed

IMPACT strength and shear fatigue of sandwich core materials can now be determined by test methods approved by Committee C-19 at its April meeting at the Massachusetts Institute of Technology. A flatwise flexure strength test method on sandwich construction was also recommended by the committee for presentation to the Society.

Other reports heard at the meeting indicated that three types of peel test are under consideration with a preference shown for the climbing drum peel test used for adhesives and developed by ASTM Committee D-14 on Adhesives. A flexure creep test, an impact test, and a form of nondestructive test on sandwich construction are also under consideration.

A second exposure program, designated Beta, was inaugurated in April with sets of panels to be tested for one, two, and three-year exposures at two ASTM sites.

In addition to subcommittee meetings, an interesting program of papers was presented, dealing particularly with the use of sandwich construction in buildings. At an evening dinner program two unusually fine talks were given by Frank W. Reinhart, National Bureau of Standards, who discussed some of the fallacies of outdoor weathering studies, and Prof. John Arnold of MIT who diverted the thinking of his audience into the subject of imaginative engineering, his subject being "Problems of Innovation."

An all-day visit to the Owens-Corning Fiberglas Corp. plant at Ashton, R. I. provided an interesting break in the series of meetings. The tour included the new marble plant, where glass marbles are produced for processing into textile yarns, and was followed by a tour of the textile plant and reinforced plastics laboratory.

Acoustical Materials

Evaluation of Basic Sound Absorption of Materials in Final Tests

PROGRESS was reported at the May meeting of Committee C-20 in New York in the basic sound-absorption evaluation of materials. A method that employs the Horn coupler which has been before the committee for some time is being prepared for use with the present impedance Method C 384, and is now being tested in round-robin series to establish reproducibility.

The measurement of sound absorption in reverberation rooms is probably the most comprehensive test method under consideration. A measurement procedure which will be circulated to the committee before the next meeting differs from Method C 384 (which is concerned with the measurement absorbent coefficient of small samples at normal incidence) in that the samples are relatively large and the incidence of sound is random.

Selection of a suitable fire-resistance test has been delayed pending completion of research programs as well as round-robin tests on types of apparatus. Under consideration are the apparati included in Federal Specification SS-A-118a; the small-scale tunnel type at the Forest Products Laboratory; and the radiant panel originally developed in Great Britain.

A research program, sponsored by the Public Buildings Administration and industry, has been resumed at the National Bureau of Standards, studying sound absorption tests of the effect of painting on acoustical tile. The effect of soiling by air impingement is also included in this program.

The need for a suitable aging test has delayed promulgation of a specification for adhesives used in application of acoustical tile. This has proved to be a difficult problem, and the committee decided to present the specification for letter ballot with the inclusion of a warning of its limitations. In this way the specification, initially introduced as a tentative and subject to further revision, will fill a need which has long been expressed.

A new model of the Baumgartner Sphere, now identified as the 10-in. sphere reflectometer, for determination of light reflectance, is being developed and a set of samples will be tested to determine light reflectance by other types of apparatus for the purpose of establishing comparative data.

Engine Antifreezes

Three Phase Program for Suitability in Actual Service

IN THE Appendix to the Tentative Method for Glassware Corrosion Test for Engine Antifreezes (D 1384 – 55 T), there is a statement that a three-phase program is necessary to determine fully the suitability of an antifreeze for actual service. The first phase is a glassware screening test, the second a bench type test simulating engine service, and the third an actual road test in vehicles. The first phase is now complete in Method D 1384, the second phase is fast becoming a reality. At the April 25 meeting of Com-

mittee D-15 on Engine Antifreezes in Washington, D. C., the Task Group on Simulated Service Test Methods reported that the coolant pump and radiator have been specified for the bench test. The reservoir, which is equivalent to an engine block, has been decided upon and patterns for the iron castings are being made. A proposed operating procedure is being drafted for this test.

The second collaborative test program gathering data on the glassware corrosion test (D 1384) is in progress. Further work on this test will compare any differences between the corrosion sample specimens being supplied by the Chemical Specialties Manufacturers Assn. and those used in the original collaborative test program.

The results of the fourth collaborative test program on the effect of antifreeze on rubber base are still not conclusive. The method and results of these studies will be circulated for further study.

Results of the second collaborative test on the glassware foaming test was reviewed.

Electronic Materials

How Clean is Super-Clean?

Is super-clean cleaner than a surgeons' glove? It could be. Super-clean is the term used to describe components for an experimental planar diode for testing electron-tube parts under development by ASTM Committee F-1 on Materials for Electron Tubes and Semiconductor Devices, which met June 6 and 7 in Boston.

Cleanliness is nothing new to the electron-tube industry, which has long known that particles of dust or lint on a tube part can cause malfunction or premature failure of the tube in service. The levels of cleanliness used become more stringent for high-reliability production tubes used in military equipment, computors, instruments, etc. Even more stringent are the precautions taken in cleaning the reference planar diode parts. In contrast with the cleaning of high-reliability tube parts which are washed and surface-etched, the planar diode parts, including particularly the nickel lead-wires, are severely etched to eliminate metal oxides which are known to be a source of gas emission which reduces tube life. Handling of parts following cleaning will be very carefully controlled to avoid recontamination, and these precautions include handling in essentially dust-free, lint-free rooms.

The committee has also about completed the development of a tentative specification for two reference triodes, one cylindrical, the other planar. Cleanliness requirements for the triodes are not so stringent as those for the planar diode. The triodes will use more or less standard production tube parts including a TV picture tube base. The extra leads available on the base will be used for adding additional electrodes so that the tube may be used experimentally as a triode, a double triode, a triode-diode and a triode or diode sublimation tube. The sublimation tube is designed with the high emission cathode coating applied to only one side of the cathode. In this way the tube can be used to evaluate sublimation characteristics of cathodes.

These reference devices, having parts and fabrication details carefully controlled, will provide a useful means for evaluating all types of materials used in electron tubes including cathodes, insulators, lead-wires, grid wires, and plates. It is expected that tentative specifications for these reference devices will be available in print toward the end of the year.

Germanium: Ultra-Pure for Transistors

Another topic actively discussed at the Boston meeting was test methods for germanium and germanium dioxide. The objective is to pinpoint the properties of the material important to the application in transistors and other semiconductor devices. Germanium, which is a by-product of zinc mining, is refined to a high degree of purity and sold as germanium dioxide. Important properties of germanium dioxide are bulk density and nonvolatile content. Nonvolatile content is important to determine actual amount of germanium in a particular lot upon which to base the price. The value of bulk density determines the amount of material which will fit in a given space when it is reduced in a hydrogen atmosphere to germanium metal. Tests for evaluating the properties of germanium metal include conductivity type and resistivity. Both these tests are run on a rectangular bar of germanium cut from an ingot of the metal. The test for conductivity type provides information as to whether the metal is n-type or p-type germanium, and thus provides a qualitative determination of the nature of the impurity, whether it is, say, arsenic or boron which do not fit precisely into the germanium crystal lattice and thus provide either a surplus or a deficiency of electrons, commonly referred to as electrons and holes. Conductivity type is measured by determining the direction of flow of a current between two electrodes which are held at different temperatures at the junction. The specimen is then tested for resistivity, which provides a measure of the amount of the impurity; the higher the resistivity in ohm centimeters the smaller the amount of impurity. Requirements for running the resistivity test on a semiconductor are different from evaluating this property of a conductor such as a copper wire. For example, semiconductors are light-sensitive, and the test must be run in the dark. Other problems involve rectification at the contact junctions.

Of the above methods, the committee has about completed the development of tests for bulk density and nonvolatile content of germanium dioxide. Additional work is needed to refine the details of methods of preparation of specimens of germanium for testing, and tests for conductivity type and for resistivity.

There are a number of other active projects in the committee involving standards for wire, strip, and insulators for electron tubes and for luminescent materials used as the coating in TV picture tubes and other cathode-ray tubes.

Random Samples . . .

FROM THE CURRENT MATERIALS NEWS

From the broad stream of current materials information flowing from "in-box" to "out-box" in a busy editorial office, random samples (mostly random) have been plucked. Thinking them worth re-showing to ASTM'ers who may have missed the original articles, we have included them here. Of course, we had to trim the samples to fit. There will be those who are not satisfied with samples, especially ones which are not really random. But these ASTM'ers can contact the institution, magazine, governmental agency, etc., who placed the original information in the stream, or address Random Samples, ASTM, 1916 Race St., Philadelphia 3, Pa.

New Tactics

CHEMISTS these days are working on some new plastics, described with new words and, what is more important, based on a new concept. The words—"isotactic," "syndyotactic," and "atactic"—were introduced by Professor Giulio Natta, of the Polytechnic Institute of Milan, to describe different arrangements of atoms in certain long-chain molecules. The concept is that these various arrangements can be "tailor-made" for particular uses by the choice of suitable catalysts.

Polymers are very large molecules formed by the joining together of small molecules, called monomers. In the case of polyethylene, the familiar "squeeze-bottle" plastic, the monomer is ethylene, a gas formed by cracking petroleum. Ethylene contains two carbons and four hydrogens, arranged in the following sequence: $CH_2{=}CH_2$. But ethylene molecules can be made to unite or "polymerize" to form long chains. A short section of such a chain looks like this:

$$—CH_2—CH_2—CH_2—CH_2—CH_2—CH_2—CH_2—CH_2—$$

Molecular chains can be more complicated; the building block can be, for example, a "substituted" ethylene monomer of the form $CH_2{=}CHR$, where R represents some atom or group of atoms other than hydrogen. (In the case of propylene, the simplest substituted ethylene, R is equivalent to CH_3.) When a substituted ethylene polymerizes, a section of the chain looks something like this:

$$—CH_2—CH(R)—CH_2—CH(R)—CH_2—CH(R)—$$

However, this structure is an oversimplification, because it does not take into account how the R groups are positioned along the chain. Different arrangements are possible. First, all of the R groups can lie either above or below the main plane of the molecule; this is the *isotactic* arrangement, and represents a highly ordered structure. Second, the R groups can alternate above and below the main plane; this structure, also highly ordered, is called *syndyotactic*. In the *atactic* arrangement, positioning of the R groups is random, and the structure is disordered. According to the new concept, these different arrangements can be achieved by controlling the chemical reaction that produces the polymer, and by choosing the most suitable catalyst, or stimulator, for the reaction.

The effect of spatial arrangement on physical properties is striking. For example, atactic polypropylene is a soft, amorphous, rather gummy substance, but isotactic polypropylene is hard and highly crystalline. The difference arises, apparently, because the highly ordered isotactic chains can pack closely together into a regular crystalline solid arrangement. Further, this close packing means that the isotactic polymer is denser than the atactic form.

At this stage of development, isotactic and atactic polymers have been obtained from simple substituted ethylenes, such as propylene. A syndyotactic polymer has been prepared from a more complicated monomer, butadiene—a building block for synthetic rubber. There has been some talk in trade journals about isotactic polyethylene, but this is really a misnomer; the newer polyethylenes should be called "linear" or "high-density" polymers. However, there is much speculation over possible future competition for polyethylene (the fastest growing plastic) from isotactic polypropylene, which is potentially cheap, and has good physical properties. Both ethylene and propylene are made in huge quantities by the petroleum industry and are used in the production of high octane gasoline. They are also important raw materials for petrochemicals such as permanent antifreeze, acetone, and synthetic detergents. Ethylene now sells for about five cents per pound; propylene is even cheaper.

Isotactic polypropylene (IP for short) is already being made on a pilot plant scale in Italy and a number of American companies are studying its potential. It appears to be twice as strong as, and more rigid than, ordinary polyethylene, and has about the same tensile strength as the new high-density polyethylenes. Also, its melting point is even higher than that of the linear polyethylenes. IP is expected to enter the same end-use markets as the various polyethylenes: film, moldings, pipe, plastic bottles, and wire and cable insulation.

Another potential use is as a synthetic fiber. Stretched IP fibers are reported to be even stronger than nylon fibers, but here the relatively low melting point may be a limitation; for comparison, the melting point of nylon is in the range 415 to 480 F. Another limitation of IP for apparel fabrics is low water absorption, which means that it will readily accumulate a static electrical charge, and therefore attract dust and lint. This limitation, however, applies to most synthetic fibers, and it may be minimized by blending with water-absorbing natural fibers such as cotton or wool. Potential nonapparel uses of IP fibers include rope, industrial filter cloths, and seat-cover and upholstery fabrics.

Although polypropylene will probably be the first commercial isotactic polymer, the general concept of tailor-making complex plastics may be more important in the long run. With the concept well established, polymer chemists are busy attempting to understand the mechanism of the reactions and applying the technique to other possible monomer-catalyst systems. Further discoveries of scientific interest and further improved plastics are inevitable.

Industrial Bulletin, Arthur D. Little, Inc. January, 1957.

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Kryptic Light

THE first commercial high brightness safety signals and markers to utilize the long-lived radioactive gas—krypton 85—have just been announced by United States Radium Corp., Morristown, N. J.

The signals and markers, designed especially for installations where power and maintenance are limited, employ treated phosphor crystals excited to luminescence by Kr^{85}. Units, available

in a variety of shapes, sizes and brightnesses, are suited for use in mining, transportation, marine and heavy industrial fields, as well as for low-level civil defense marking or other application where little power is available for illumination of signal lights.

The devices, readily visible at distances in excess of 500 yards, are adaptable to a wide range of signal, directional, and marking systems. Colors available include blue, green, yellow, pale orange, and orange-red.

Sources are enclosed in hermetically sealed, transparent capsules which are weather- and tamperproof, requiring no maintenance from the first day of installation. Circuit installation costs are likewise eliminated, as are replacements of transformers, batteries, or bulbs. Refueling and cleaning of oil lamps used as signals are no longer required.

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Porosity Test

A NEW portable testing machine for measuring porosity has been announced by the American Instrument Co., Inc. of Silver Springs, Md.

The size and number of pores in materials is an important item to various segments of industry. When the size and number of pores in many materials are known, the quality and performance of the product can be accurately predicted. For example, the quality and performance of filters, or battery separator plates can be determined through pore-structure analysis of the various parts. Such predictions can be made on any substance that has pores—metals, fuels, plastics, chemicals, textiles, leather, building materials, ceramics, and many others.

The Porosimeter measures the sizes of pores in any material with pores ranging from 0.1 mm. to 0.06μ, and determines pore volumes as small as 0.0005 ml at each pore diameter. The instrument works on the principle that mercury will penetrate any porous material if sufficient pressure is applied. Initially an experiment is run by placing a small specimen of the material to be tested within a glass enclosure. Only pressures below atmospheric are used to force mercury into the pores while the specimen is kept in this location. To measure very small pores the specimen is moved to a vertically sliding, stainless steel pressure vessel. Here, pressures up to 3000 psi are applied to the sample. Pressure is fed to the testing vessel through a series of stainless steel tubes. As pressure is raised, mercury is forced into smaller and smaller pores, the volumes of which are continually being indicated by the mercury level as it drops in the calibrated container.

Your Committee Officers

A new series—to better acquaint BULLETIN readers with the men whose responsibility it is to direct the indispensable work of the ASTM technical committees.

Committee A-5 on Corrosion of Iron and Steel

Chairman—**Marc Darrin,** associate director of research, Mutual Chemical Div., Allied Chemical and Dye Corp.

First Vice-Chairman—**H. F. Hormann,** Mechanical Engineering Dept., Consolidated Edison Co. of New York

Second Vice-Chairman—**E. F. Lundeen,** assistant superintendent, quality control, Inland Steel Co.

Secretary—**C. P. Larrabee,** Applied Research Laboratory, United States Steel Corp.

Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys

Chairman—**K. G. Compton,** Mechanical Staff, Bell Telephone Laboratories, Inc.

Vice-Chairman—**E. K. Camp,** International Business Machines Corp.

Secretary—**A. W. Tracy,** assistant metallurgist, The American Brass Co.

Sampling Plans in ASTM Specifications

—A report of a preliminary survey conducted by Task Group 4[1] of ASTM Committee E-11 on Quality Control of Materials

Many ASTM materials specifications describe how the material is to be sampled and specify the number of specimens that must be taken and tested in accordance with the methods defined therein. These specifications, when covering specific items as distinct from general classes or types of material, give standard values and tolerances for essential properties, such as chemical composition, dimensions, weight, strength, etc. In many cases, the specifications provide that when the test results fall within the prescribed tolerances, the material is judged as conforming to the specification, otherwise it is judged as nonconforming.

The increased use of formalized statistical sampling plans over the past decade has raised questions regarding the sampling plans in ASTM specifications which led to this survey.

Should Sampling Plans Be Included?

Before discussing the results of the survey, attention should be called to the fact that a number of leaders in the field of standardization of specifications feel that consideration should be given to eliminating inspection and sampling clauses from product specifications. They believe that materials specifications should contain two parts only: (1) the design requirements which define the dimensions, physical and chemical properties, workmanship, and performance characteristics which the material shall have, and (2) the methods of test which define the analytical engineering procedures to be followed in conducting an individual test.

They believe that the acceptance requirements which define the inspection and sampling to be performed on a material to establish that it conforms with the design requirements should form a separate inspection specification, developed for the particular contract between buyer and seller.

A basic objection to the inclusion of sampling plans in specifications is that suppliers may have differing degrees of control of quality in manufacturing the same material, thereby justifying different amounts of inspection and sampling. Many ASTM sampling plans specify a fixed sample size and it is argued that these are not applicable to all the situations met in industrial practice. Consequently, while some manufacturers employ ASTM specifications in materials purchasing as far as design requirements and test methods are concerned, they use their own sampling plans for determining conformance to the specification. The intent of a separate inspection specification is to separate the judicial (inspection) function from the legislative (specification) function and to provide the flexibility in sampling plans necessary for local inspection circumstances, variations in the requirements of purchasers, and changes in the procurement picture.

The survey of sampling plans was done on standards of 1946. Despite this, the committee believes that the results are still pertinent and of interest to the general membership. The survey included the ASTM standards contained in the five parts of the Book of ASTM Standards (Table I). 1320 ASTM Standards and Tentatives were in these five parts. Approximately 750 of them were specifications and the remainder primarily methods of test. Of the 750 specifications 10 per cent or 75 were selected as a sample and studied for the purpose of tabulating and summarizing the results. The 75 specifications involved 443 characteristics falling under five classifications. (1) chemical, (2) physical, (3) dimension and weight, (4) visual and finish, and (5) electrical.

[1] Members of the Task Group are: O. P. Beckwith, Chairman, Simon Collier, H. F. Dodge, L. E. Simon, and P. J. Smith. G. H. Harnden was chairman when the survey was made.

TABLE I.—ASTM STANDARDS REVIEWED IN SURVEY SAMPLE.

Part IA	Ferrous Metals (Steel, Wrought Iron, Cast Iron, Magnetic Properties, Malleable Iron Castings, Ferro-Alloys, Iron-Chromium Nickel and Related Alloys).
Part IB	Non-Ferrous Metals (Copper and Copper-Alloy Wires, Non-Ferrous Metals and Alloys, Light Metals, Electrodeposited Metallic Coatings, Metal Powders and Metal Products, Electrical-Heating Alloys, Copper and Copper Alloys, and Die Cast Metals and Alloys).
Part II	Non-Metallic Materials—Constructional (Cement, Lime, Gypsum, Masonry Units, Natural Building Stone Mortar for Unit Masonry, Thermal Insulating Materials, Refractories, Glass and Glass Products, Clay Pipe, Concrete Pipe, Drain Tile, Concrete and Concrete Aggregates, Road and Paving Materials, Nails, Waterproofing and Roofing Materials, Wood and Wood Preservatives, Paint, Varnish, Lacquer, and Related Products, Naval Stores, Fire Tests, Thermometers).
Part IIIA	Non-Metallic Materials (Coal and Coke, Petroleum Products, Aromatic Hydrocarbons, Soaps, Water, Textiles, Gaseous Fuels, Thermometers).
Part IIIB	Non-Metallic Materials (Electrical Insulating Materials, Plastics, Rubber, Paper, Shipping Containers, Adhesives).

What the Survey Showed

The survey showed the following as interpreted by members of the Task Group who conducted it.

1. Purpose of Inspection

Process control	1 per cent
Product acceptance	99 per cent

2. Method of Handling Material

In bulk (not packaged)	64 per cent
Packaged	36 per cent

This breakdown indicates whether the material is packaged or not packaged at the time it is sampled.

3. Form of Material

Solid, Aggregate—Such as crushed rock, cement, sand, coal, pellets, etc.	13 per cent
Solid, Discrete—Solid material each integral unit of which, when broken down, partitioned, etc., physically neither retains its original form nor can it be used as originally intended, for example, nails, nuts, bolts	20 per cent
Continuous—Solid material which is extruded, drawn, rolled, etc.	55 per cent
Liquid—Self explanatory	12 per cent
Gas—Self explanatory	0 per cent

4. Definition of Lot

This breakdown indicates whether the specification designates a specific quantity, shipment, lot,

"universe," etc., which will be sampled with respect to the particular characteristic considered.

Yes	78 per cent
No	21 per cent
Indefinite	1 per cent

5. *Make-Up of Lot of Shipment*

This breakdown indicates whether the specification considers the lot or shipment uniform in composition, such as all the material from one heat, one production line, one batch, etc.

Uniform	29 per cent
Not uniform	1 per cent
Indefinite	70 per cent

6. *Method of Sampling*

Random.—If specification uses the term "random" specifically, this category is checked .... 23 per cent

Stratified or Representative.—If manner of sampling, as specified, is such that all possible strata in the lot are purposely represented, then this category is checked .... 32 per cent

Purposive.—If specification designates a particular part or portion of the material, to be used as a sample, then this category is checked, for example, end of pipe, top of ingot, etc. .... 6 per cent

Indefinite.—If no mention is made or inference given as to sample size or quantity in the specification, then this category is checked .... 39 per cent

7. *Size of Initial Sample—Number of Articles or Specimens in Initial Sample*

Sample Size Stated.—If a quantity (or sample size) is given specifically in the specification, then this category is checked .... 74 per cent

Sample Size Implied.—If a quantity (or sample size) may be inferred from the wording of the specification then this category is checked .... 6 per cent

Sample Size Indefinite.—If no mention is made or inference given as to sample size or quantity in specification, then this category is checked .... 20 per cent

8. *Acceptance Criterion*

Criterion Stated.—If acceptance requirement is given and if the sample statistic which is to be checked against this requirement is specified, then this category is checked .... 79 per cent

Criterion Implied.—If either of the above stated conditions is met, but not both, then this category is checked. Also, if knowledge of procedures in practice infer an acceptance criterion though not specifically, this category is checked. 18 per cent

Criterion Indefinite.—If no criterion is stated or implied, then this category is checked .... 3 per cent

9. *Retest Provisions*

If a retest is specifically mentioned in the specification, then *yes* is checked; otherwise no is checked.

Yes	37 per cent
No	63 per cent

10. *Size of Retest Sample—Number of Articles or Specimens in Retest Sample*

Sample Size Stated.—If a quantity (or sample size) is given specifically in the specification, then this category is checked .... 91 per cent

Sample Size Implied.—If a quantity (or sample size) may be inferred from the wording of the specification, then this category is checked .... 6 per cent

Sample Size Indefinite.—If no mention is made or inference given as to sample size or quantity in the specification, then this category is checked .. 3 per cent

11. *Retest Acceptance Criteria*

Criterion Stated.—If retest acceptance requirement is given and if the sample statistic which is to be checked against this requirement is specified, then this category is checked .... 91 per cent

Criterion Implied.—If either of the above stated conditions is met, but not both, then this category is checked. Also, if knowledge of procedures in practice infer a retest acceptance criterion, though not specifically, this category is checked .... 6 per cent

Criterion Indefinite.—If no retest criterion is stated or implied, then this category is checked .... 3 per cent

12. *Retest Acceptance Criterion Applied To*

If literal translation of specification definitely designates a category, then this is checked. In all cases where the literal translation leaves any doubt whatsoever the category "indefinite" is checked.

Second sample only	81 per cent
First and second sample combined	3 per cent
Indefinite	16 per cent

13. *Limit to Number of Retests*

Limit Stated.—If a limit to number of retests is stated or can be inferred this category is checked 90 per cent

Limit Not Stated.—If a limit to number of retests is stated or can be inferred, this category is checked .... 1 per cent

Indefinite.—If no mention of limit to number of retests, then this category is checked .... 9 per cent

14. *Rejection Applies to*

If literal translation of the specification definitely designates that rejection applies to one of the following categories then it is so noted. In all cases where the literal translation leaves any doubt, the category "indefinite" is checked.

Lot	32 per cent
Sample only	0 per cent
Defective material in lot	13 per cent
Defective material in sample	1 per cent
Indefinite	54 per cent

15. *Inspection Done by*

If literal translation of the specification definitely designates that inspection is done by one of the following then this category is checked. In all cases where the literal translation leaves any doubt, the category headed "indefinite" is checked.

Manufacturer	15 per cent
Purchaser	18 per cent
Both manufacturer and purchaser	4 per cent
Either manufacturer or purchaser	12 per cent
Independent agency	1 per cent
Indefinite	50 per cent

Data Interpreted in Context

In studying the survey results it is apparent that there is some indefiniteness in the sampling plans of a number of ASTM specifications. It should be kept in mind, however, that the survey data need to be interpreted in the context of the ASTM specification. For example, some sampling plans require inspection at the manufacturer's plant by the purchaser's representatives. In certain of these no instructions are given as to how samples should be selected or the number to take in judging whether a lot of material conforms to the specification requirements. Reliance is placed on the inspector's knowledge of the material and the quality level of the seller's plant. Such a system can be effective, perhaps even more so than when a fixed size sampling plan is specified. The reason for this is that a sampling plan with a fixed sample size, as is the case in many ASTM specifications, will be most appropriate when production is controlled at a particular quality level. When production varies from this level or is uncontrolled, then some other sample size may be needed. In addition, when the order of manufacture of items composing a lot is known, sampling it for the evaluation of quality can be done more efficiently and with greater assurance than when nothing is known about the makeup of a lot. An inspector at the pro-

ducer's plant has the opportunity to obtain this knowledge and to modify his sampling activities as circumstances require.

In some cases ASTM specifications state that the manufacturer and purchaser shall agree on a sampling plan. While this is indefinite it is not unsound since the best sampling plan may be the one that fits the specific situation.

Theoretically at least, agreement of manufacturer and purchaser on a sampling plan means consideration of the manufacturer's quality level and capability, the requirements of the purchaser, and the makeup of production lots.

Data Analyzed

In order to give a more complete picture of ASTM sampling plans, a number of them are presented in Tables II, III, IV, and V. Classification is by material groups, that is, solid-aggregate, solid-discrete, solid-continuous, and liquid. While the information is abbreviated, the important points such as who performs inspection, definition of lot, method of selection sample, size of sample, acceptance criteria, etc. are given if they were specified.

From item 1 of the survey it would appear that the principal purpose of inspection is product acceptance; the purpose however is not always clearly stated. There are some process-control specifications, one such is shown in Table III, Specification G.

Some ASTM specifications do not say what is to be done when the tests made do not meet the specified requirements.

Items 2 and 3 of the survey show the importance of mass materials in ASTM standards. Solids as aggregates and in continuous length constitute two-thirds of the sample specifications. Because of this, Committee E-11 organized, several years ago, a task group on bulk sampling of materials. A Tentative Recommended Practice on the Probability Sampling of Materials E 105 - 54 T[2] has been prepared for the guidance of writers of sampling plans for specific materials. An example of the application of these principles is found in ASTM Tentative Methods of Core Sampling of Wool in Packages for Determination of Total Wool Fiber Present D1060 - 53T[3]. This method describes the manner in which samples are taken from bales of wool, gives data on the variability of yield within bales and between bales for classes of wool based on past experience, and a sampling table listing the number of samples to take for different degrees of precision at a probability of 95 in 100. In addition provision is made for ascertaining the minimum cost of sampling. This standard has been widely used in the buying and selling of wool in the few years of its existence.

Item 4 indicates whether a specific quantity, shipment, lot, etc., is to be sampled with respect to a particular characteristic. It will be noted that an appreciable percentage of the specifications studied did not state any specific quantity. Presumably the buyer and seller agree on what constitutes a lot and the samples to take therefrom. Obviously, if a sample size is given, the quantity of material which it is to represent should be indicated.

Item 6, Method of Sampling, shows that a good portion of the ASTM specifications sampled were indefinite on the manner of selecting the sample, that is, as a random, stratified, or purposive sampling. A recent article entitled "The Sampling Operation in Acceptance Sampling of Glass Containers"[4] by J. E. Toulouse, shows strikingly how the production process can produce strata in a lot. The article points out that lack of adherence to strict rules of random sampling in such a situation gives disastrous results in judging the quality of a shipment of glass containers. ASTM Tentative Method of Sampling Glass Containers, (C 224 - 53 T)[5] embodies the sampling procedure described in this article.

Item 7 deals with size of initial sample. A considerable percentage of the standards in the survey were indefinite on this point. Committee D-13 on Textiles, faced with the problem of improving the basis for specifying the number of samples to take in textile specifications and standards, developed a Proposed Recommended Practice for Calculating Number of Tests to be Specified in Determining Average Quality of a Textile Material.[6]

It will be noted in Tables II, III, IV, and V that some ASTM sampling plans call for sampling a percentage of the lot.

TABLE II.—SAMPLING PLANS FOR SOLID AGGREGATE PRODUCTS—EXTRACTS.

Specification A. .	Sample 20 per cent of the packages in a lot. If 85 per cent of the sample conforms to the specification requirements, accept this lot. If less than 85 per cent of the sample does not conform, sample up to 50 per cent.
Specification B. .	1. Sample at point of manufacture wherever possible so that acceptance or rejection can be made in advance of shipment.
	2. When a lot of material is from a single run or batch one package shall be selected at random and sampled. Where the lot is not from a single-run sample a number of packages at random equivalent to the cube root of the total number of packages in the lot.
Specification C. .	1. Sampling and inspection either at mill or site of work as specified by purchaser.
	2. Samples taken may be tested as individuals or composited.
	3. Each test sample represents not more than 2000 units of weight.
	4. Sample, if taken at conveyor delivering to bulk storage, can be taken at one grab or intervals. Sample shall represent not more than 2000 units of weight nor more than 6 hr production.
	5. If sample is taken at discharge from bulk storage same applies as in 4.
	6. Sample may be taken from bulk storage if depth of material from points well distributed over the storage area.
	7. In all other cases samples are taken from each 50 units of weight and combined to form a test sample representing not more than 2000 units of weight.
	8. Material may be rejected if it fails to meet any of the requirements of the specification.
Specification D. .	1. Sampling and inspection shall take place at point of manufacture or destination as designated by purchaser.
	2. Samples may be taken from conveyors delivering to bins or piles, from filled bins by means of sampling tubes, from filled bins at the point of discharge, from piles by means of sampling tubes or shrouds, or from loaded cars.
	3. Samples taken in triplicate shall be not less than 5 lb each when the quantity sampled is 40 tons or more.
	4. One sample goes to consignee, one to consignors, one held for referee test.
	5. In sampling from piles or cars, material shall be selected so that it represents an average of all parts of the pile or car—10 shovelsfull from different parts of the car. Not less than 100 lb for 30 tons, mixed and quartered, and triplicate samples taken.
	6. At conveyors material is taken at regular intervals such that the amount taken conforms to that specified in 5.
	7. For lump or granulated material 2 per cent of packages are sampled, composited, and triplicate samples selected.
	8. For powdered material 1 to 5 per cent of packages are sampled, composited, and triplicate samples selected.
	9. Rejection of material is based on failure of sample to pass tests. If purchaser and manufacturer do not agree to test results, the third sample is sent to referee laboratory and results are binding on both parties.

[2] 1956 Supplement to 1955 Book of ASTM Standards, Part 1, p. 442; Part 3, p. 312; Part 4, p. 198; Part 5, p. 261; Part 6, p. 327.

[3] 1955 Book of ASTM Standards, Part 7, p. 527.

[4] *Industrial Quality Control*, Am. Soc. Quality Control, Vol. X, No. 6, pp. 32–35.

[5] 1955 Book of ASTM Standards, Part 3, p. 929.

[6] ASTM Standards on Textile Materials, Am. Soc. Testing Mats., p. 685 (1956).

TABLE III.—SAMPLING PLANS FOR SOLID DISCRETE PRODUCTS—EXTRACTS.

Specification A..

1. Inspection and tests are done at manufacturer's plant prior to shipment wherever possible. Inspector represents purchaser.
2. Purchaser may make the tests to govern acceptance or rejection in his own laboratory or elsewhere.
3. Material is submitted for inspection in lots of 500. 10 per cent of units are sampled.
4. If 75 per cent of units in sample conform, test all units in lot.
5. If less than 75 per cent of units conform, reject lot.
6. Provision is made for review of rejection. Rejected material may be submitted again after reworking.

Specification B..

1. Inspection and tests done at manufacturer's plant by representative of purchaser.
2. Make one test for each heat in each lot.
3. If mutually agreed, after acceptance of 10 heats, manufacturer may assemble castings in groups of 5 heats—one test specimen from every 5th heat provided that tests fall within range established by first 10 consecutive heats.
4. When rejection occurs based on these tests, manufacturer can have review of rejection made.

Specification C..

1. Inspection and tests are done at manufacturer's plant prior to shipment wherever possible. Inspector represents purchaser.
2. One test shall be made from each heat in each heat treatment change.
3. If any of the results do not conform, manufacturer may re-treat such lots and retests shall be made.
4. In shop working of forgings, if 10 per cent of the foreings in any heat-treatment charge fail to conform to the specified chemical and mechanical requirements, the entire lot may be rejected.
5. When rejection occurs based on these tests, manufacturer can have review made of rejection.

Specification D..

1. Two items per keg are sampled.
2. Periodic control tests made on each lot of material may be considered sufficient for certification.
3. If results of tests do not conform to requirements, two additional tests shall be made—each of which shall conform.
4. When rejection occurs based on these tests, manufacturer can have review made of rejection.

Specification E..

1. Inspection shall take place at manufacturer's plant or site of work. Inspector is purchaser's representative.
2. Select at least 5 items from each kiln or from each lot of 100 tons. Additional specimens may be taken at discretion of purchaser.
3. If the shipment fails to conform, manufacturer may sort it and new specimens can be selected by purchaser. If second set of specimens does not conform, the entire lot shall be rejected.

Specification F..

1. Material, as delivered at site, shall not contain more than 5 per cent of broken units.
2. For physical tests at least 5 units shall be selected from each lot of 50,000. For lots of more than 500,000, 5 units are selected from each 100,000.

Specification G..

1. At least one item out of each 50 shall be selected at random and gaged.
2. At least one item shall be selected at random during every hour of production, but not less than one out of every 1000 items.
3. A record is kept by manufacturer of tests made on each day's production. These records shall be available to the purchaser at his request.

Specification H..

1. Manufacturer's Production Sampling.
   a. Visual inspection of each item shall be made.
   b. One item out of each 50 shall be gaged.
   c. Record of manufacturer's daily tests shall be kept and this shall be available to purchaser.
2. Purchaser's Acceptance Tests.
   a. Sample insulators shall be selected from the lot at random as follows:

	Number of Items in Lot		
	0 to 5000	5000 to 10,000	Over 10,000
Visual tests..	32	46	60
Gaging......	10	15	20

   b. Failure of more than one specimen to conform to visual tests shall be cause for rejection of the entire lot.
   Failure of over 5 per cent of the sample to conform to the gaging requirements shall be cause for rejection of the entire lot.

TABLE IV.—SAMPLING PLANS FOR SOLID-CONTINUOUS PRODUCTS—EXTRACTS.

Specification A..

1. Inspection and tests are done at manufacturer's plant prior to shipment wherever possible. Inspector represents purchaser.
2. One set of tests on each lot of 500 lengths.
3. Where results of tests do not conform, retests are made on double the original number from the same lot, each of which shall conform to the requirements specified.

Specification B..

1. From each shipment sample a total number of rolls equal to one half the cube root of the total number of rolls in the lot.
2. Failure to conform to any one of the requirements prescribed shall constitute grounds for rejection. The manufacturer has the right to re-inspect the rejected shipment and re-submit the lot after removal of those packages not conforming.

Specification C..

1. If the lot consists of less than 20 coils, one measurement shall be made on each of 2 coils. If the lot is 20 or more coils, 10 per cent of the coils shall be selected at random and at least one determination made on each roll.
2. If thickness is found to be less than that specified on any coil, that coil is rejected and a thickness measurement on remaining coils is made.
3. If more than 10 per cent of samples fail, all coils shall be rejected. If less than 10 per cent fail, all coils may be tested and accepted or rejected based on individual results.

Specification D..

1. Tests shall be made on samples taken from 20 per cent of the rolls in each shipment. Five tests shall be made on each roll.
2. Seller has opportunity of checking the tests and if agreement cannot be reached, tests shall be made by a referee whose decision shall be final.

Specification E..

1. Rolls shall be selected from each shipment in accordance with the following schedule:

Number of Rolls in Shipment	Minimum Number of Sample Rolls
Over 10,000	1 per thousand
5001 to 10,000	10
2001 to 5000	5
501 to 2000	2
201 to 400	1
Less than 200	Optional

2. The failure of 20 per cent or more of the sample rolls to conform to the requirements shall constitute cause for rejection of the entire shipment.
3. If manufacturer desires, he may resample rejected shipment and submit sample to a referee whose decision is final.

TABLE V.—SAMPLING PLAN FOR LIQUID PRODUCTS—EXTRACTS.

Specification A	1. Shipments consisting of a number of separate drums, cans, barrels, etc., shall have a number opened and samples equal to the cube root of the total number in the lot.
	2. Not less than 1 per cent of the shipping containers shall be sampled at random. The individual samples are then composited.
Specification B	1. At least 5 per cent of the containers in any shipment shall be sampled. A composite sample is prepared.
	2. Not less than a 1-qt sample shall be taken from a given lot. Sample may be taken from bulk storage, during loading, from material under pressure, material flowing by gravity, tank cars, barrels, drums.

Such a procedure is usually considered inefficient when a product of discrete articles and a wide range of lot sizes is under consideration. In lots containing a small number of units, a percentage sample, say 5 or 10 per cent, may be inadequate to describe effectively the quality of the lot. In lots containing thousands of units the percentage sample gives an excessive number of units.

The remaining points in the survey indicate a certain amount of indefiniteness in acceptance criteria, size of retest samples, retest acceptance criteria, limits to number of retests, what rejection applies to, and the responsibility for inspection. A large percentage of standards are indefinite as to what is to be rejected when an instance of nonconformance is encountered, for example, the lot, sample, defective material in the lot or defective material in the sample.

The survey of sampling plans in ASTM standards has brought out the need for more exactness in describing them. While it is not within the scope of the survey, it may be appropriate to raise the question as to whether ASTM sampling plans are adequate for all the situations where the specification may be used. Is the sampling plan applicable to a single lot, a continuous series of lots, and to the good producer as well as the poor? For a sampling plan to properly apply in all such situations requires considerable flexibility of application. On the other hand, the provision of one sample size only for a given lot size, such as is characteristic of many ASTM standards, is probably not adequate for all conditions of use.

When a product is received from a manufacturer in a continuing series of lots, and statistical control has been demonstrated, the sample size required in order to reach a decision will be smaller than where control has not been demonstrated. When a single lot is involved and no information exists as to the expected frequency of defects in the process by which it was made, good sense would call for a greater number of specimens than for each lot in a series of lots from controlled product.

These problems are being recognized in some of our specifications. One such standard is the Specifications for Hard-Drawn Copper Wire (B1-56)[7]. This is quite specific as to the sample size to take for various lot sizes, the allowable number of defective units in the sample, and the action to take when individual production units fail to meet one or more of the requirements. A footnote in the specification states that.

> Cumulative results secured on the product at a single manufacturer, indicating continued conformance to the criteria, are necessary to insure an over-all product meeting the requirements of these specifications. The sample sizes and conformance criteria given for the various characteristics are applicable only to lots produced under these conditions.

In other words, this statement makes it clear that the criteria apply only to a continuing series of lots of large quantity made under controlled conditions. This general acceptance procedure is applicable to a number of like materials and could advantageously be placed in a separate ASTM standard method of sampling.

Several technical committees of the Society have developed standard methods of sampling applicable to a class of materials. Specifications for a particular material reference such sampling plans when discussing the number of samples to take from a lot. There is no one available practice that describes the way in which sampling plans should be developed for ASTM specifications, since with the wide variety of products covered by these specifications, no one single plan could be expected to be applicable.

Recommendations for Improvement of Sampling Plans

To improve the sampling, plans in ASTM specifications, two phases of action are required—immediate, and long range. The survey of sampling plans just described points out some shortcomings that can be avoided. For the long run, however, a considerable program of study and development by the technical committee concerned is necessary.

The following list of questions may be helpful in preparing or revising ASTM specifications.

A. *Purpose*

1. Is the purpose of sampling inspection mentioned in the standard, that is, for process control, lot acceptance, product quality checks by producer, settlement of disputes?
2. If the purpose is lot acceptance:
   (a) Is the lot defined as to size?
   (b) Is the lot defined as a rational subgroup of product, for example, all material from one heat, one batch, etc., or as a mixture of several producing units?

B. *Selection of the Sample*

1. Who is to perform the sampling inspection—producer, purchaser?
2. Where is the sampling to be done—at the manufacturer's plant or at customer's plant?
3. Is the technique of selecting and preparing a specimen clearly defined?
4. Is a lot to be randomly sampled, or divided into strata and randomly sampled, or is the sample to be taken from a articular part or portion of the material?

C. *Evaluation of the Quality of the Lot on the Basis of the Sample*

1. Is the size of the sample (number of tests) defined?
2. Is the number of tests to make on a single item of the sample specified?
3. Are the criteria for nonconformance defined?
4. When a unit is tested for more than one characteristic and some but not all requirements are met, is the action to take defined?
5. Are retest provisions included?
6. Is there a clear statement as to what nonconformance applies to?
7. Is the sampling plan based on a study of process capability of producers in the industry?

In conclusion, the development of statistically based sampling plans in ASTM specifications will have significant consequences. Better utilization of present testing effort through improved sampling and presentation and interpretation of data can be expected. In Society activity the interchange of experience among different technical committees on the common problems of sampling diverse materials could be very helpful. For example, the textile industry does not employ the principle of inspection at the vendor's plant such as is used for ferrous metals. Nevertheless, to do so, with adequate sampling plans, might greatly reduce the testing now carried on at the purchaser's plant. The task group's survey of sampling plans in ASTM specifications suggests the need for improvement in them. It is hoped that the data given in the report will stimulate increased action on the matter by the technical committees.

[7] 1955 Book of ASTM Standards, Part 2, p. 1.

The Bookshelf

Rheology: Theory and Applications Vol. I

Frederick R. Eirich, Editor; Academic Press, Inc., New York, N. Y.; 761 pp.; $20.

This first of three volumes in a set is a compilation of the fundamental concepts of rheology underlying most of its many applications. Volumes II and III will presumably deal with the applications and techniques for observing them. The contributors are of international reputation and have few peers on the subjects they present. Although many individual papers and a number of books have appeared in the last three decades on the subject of viscosity and various other "deformations of matter" as influenced by temperature, time, and stress, there has been a serious need for a boiling-down all in one place. Engineers, chemists, and physicists will find Professor Eirich's outstanding collection useful as handbooks, references, and theoretical texts.

Volume I, although introduced by two chapters on the basic physicochemical and engineering aspects of flow and elasticity, will require effortful concentration for the neophyte. This book is beefsteak, not porridge. In addition, a good mathematical background is required.

Five chapters on the deformation of solids give the present-day analysis of plastic, elastic, and viscous response of crystalline and amorphous solids in general, and viscous response of crystalline and amorphous solids in general, particularly metals, and treat of their creep, hysteresis, and anelasticity. The next two chapters are concerned with the phenomenology of the effect of compression on the flow of fluids, and the theories of liquid flow as influenced by molecular structure.

Many analyses of elastic response are based on the assumption of linear relations between stress and strain as long as small strains are involved. The next chapter shows that in many cases large deformations can be so handled by considering them as superpositions of small deformations of known history. There follows a chapter on the three-dimensional stress response analysis of high polymer plastics in shear. Functions describing creep, torsion, and vibration are presented.

The next three chapters deal with the seemingly anomalous flow behavior of high polymers as melts, dispersions, in solution, dilute and concentrated. The aims are to explain these observations through molecular and colloidal structure, molecular weight dispersion, and solvent influence.

An analysis of the effect of molecular orientation during flow on streaming and stress birefringence and its application to colloidal structures precedes a chapter on the nonlinear flow response of fluids to shearing stress, and explanations of apparent discrepancies.

A chapter on the acoustical properties of the liquid state as an insight to describing its structure, is the last of the 17 chapters in this unusual book.

W. H. Markwood, Jr.

The Oscilloscope at Work

A. Haas and R. W. Hallows; Philosophical Library, New York, N. Y.; 171 pp.; $10.

Despite the rapid growth of the oscilloscope as a measuring instrument in recent years, few texts have appeared to explain its design and application. In the electronics field, the oscilloscope is a well known and accepted tool for analyzing electrical phenomena, but more and more it is finding wide application in the fields of stress analysis, vibration, pressure studies, and in many other electromechanical problems where dynamic phenomena must be analyzed. Unfortunately, this book, originally published in France and adapted for English-speaking readers, deals primarily with the use of the oscilloscope to study electrical signals and almost completely avoids any discussion of the equally intriguing "nonelectrical" fields of application.

The book covers an extremely wide range of subject material, beginning with a very elementary treatment of the general characteristics and circuitry of an oscilloscope. As the authors expand on the basic circuits of the oscilloscope to describe various audio and radio frequency amplifiers that are incorporated in the instrument, they also interweave numerous measurements that can be made on such amplifiers that exist in equipment, other than the oscilloscope itself. The same approach is taken to discuss not only the oscillators in oscilloscopes themselves, but the general subject of oscillators—by no means a small task in the short space allotted.

The interweaving of information continues even to the extent of suggesting circuit designs for accessory instruments to the oscilloscope, whenever the need arises for a particular application. For example, a simple electronic switch circuit is given for dual trace applications. In another case, the reader is encouraged to build a sweep generator for the plotting of response curves of amplifiers. This reviewer doubts that the average reader could build these instruments from the sketchy details given. The authors might better have gone into greater detail on the application of the oscilloscope and these accessory instruments, rather than sidetracking the reader periodically to build accessories that are now commonly available as commercial catalog items.

An important feature of the book is the large number of oscillograms depicting the wave forms that can be expected in the applications described. Over 200 oscillograms are presented, but, unfortunately, many of them lose their impact because they lack contrast and sharpness of detail. With modern oscilloscope-recording cameras and high resolution cathode-ray tubes now available, much higher quality oscillograms are possible.

The line drawings of circuits, on the other hand, are very clear and the symbols almost entirely identical with those used in this country.

This book may be useful as an introduction to electrical measurements, primarily in basic electronic circuits. For its understanding, it requires at least an elementary knowledge of electronic circuits, and as such, is probably best suited as a textbook for a college course in measurements. Its elementary approach makes it suited also for technical trade schools.

Notably lacking for the more advanced user of oscilloscopes is any discussion of modern oscilloscope circuits, phosphorescent screen characteristics, study of high speed transients, signal and sweep delay techniques, etc. The nonelectrical engineer will also have to look elsewhere for information on the application of the oscilloscope for studies that employ electromechanical transducers to convert other forms of energy, such as light, heat, sound, pressure, vibration, etc., into electrical signals, which can then be displayed on the scope screen.

Morton G. Scheraga

High-Temperature Protective Coatings For Magnesium

WADC Technical Report 56-622; Wright Air Development Center, Wright-Patterson Air Force Base, Ohio; 104 pp.

This research project was set up to determine what type of high-temperature protective coating can be employed over magnesium alloys used in aircraft. In this report, the work of developing an air-drying coating system for magnesium which would have film properties equal to or better than present air-drying finishing systems, as well as withstanding operation temperatures up to 500 F, is presented in detail. The report contains charts and photographs of the test reports and exposed materials of the finishes used. For the most part silicones were used for this project. The project came to a successful conclusion with two recommended coating systems. The vehicles on which these two systems are based are: (1) a styrenated acrylonitrile modified alkyd-silicone copolymer resin; and (2) a mixture of an epoxy ester and a silicone resin.

(Continued on page 111)

Our Expanding Technology and ASTM

Annual Address by the President—June 18, 1957

RUDOLPH A. SCHATZEL
Vice-president and director of engineering, Rome Cable Corp.

DURING the past six months I have had the great privilege and stimulating experience of visiting all our District Councils except one—the Ohio Valley District. We however, visited three other sections of the country where there are no districts, but where interest in ASTM is very much alive.

Each year at this time a short period is provided for your President to sing his "swan song" and then resume his place in the ranks to work for the Society under a new leader. That I pledge most willingly to do. I do not have any stirring message to bring you to repay you for the honor you have done me these many years and particularly this last, as I have served as your President. I should like to talk to you a few moments about our visit and present to you some thoughts on our Society.

As we traveled from District to District I was greatly impressed by the tremendously varied technologies, with the virility of interest and appreciation of our task in ASTM, the desire to advance the interest of our Society, and the loyalty and pride of so many who have served the Society so well so long. Our forty and fifty-year members, Past-Presidents, honorary members, and committee members now long retired were on hand to advise and eager to hear of the Society's plans and accomplishment. At times they gently chided us about some pet project which is not moving with appropriate speed. These men and our committees are our Society, and we can all be justly proud.

Our visit to the unique Hot Metallurgical Laboratory of the Hanford Atomic Energy plant in Washington, and attendance later as your honored representative at the Nuclear Congress left an unforgettable memory and realization of the great strides and rapid changes in our technology.

The immediacy of our task became apparent from our discussions at Hanford. The questions were, how can we fit into ASTM better? and can ASTM do more to help us on our problems? Fortunately we have many committees studying the latter question and an over-all committee coordinating activities in the nuclear field. Whether we were inspecting models of the various dams designed to harness the rivers of the world, or attending meetings of over 400 men in one of our committees discussing mass spectrometry, the contribution of our Society in the development of new technologies was most evident and inspiring.

The Need for Better Communication

During our travels we also came in contact with many who are not members of ASTM who sometimes shocked us with their lack of knowledge of what ASTM is, and does. The following are typical of some of the questions asked:

1. How does ASTM affect our community? This I attempted to answer in my talk in Los Angeles,[1] since the roads they travel on, the water they drink, their houses, and the clothes they wear—are all affected by ASTM research and standards.

2. "What is ASTM?" This question was asked by a state secretary of a leading professional engineering group, at a large dinner on Engineers' Day—a very charming and intelligent gentleman.

3. "Does ASTM develop Standards? I thought that was done by the American Standards Assn." This was asked by an English scientist visiting this country and very much concerned with standardization in England. When shown the statement in the constitution of ASA that its purpose is to stimulate the work of existing organizations and to encourage the establishment of organizations if none exist, but not to formulate standards, he said, "Well, well!"

4. A visiting French scientist with considerable acquaintance in America in the electrical industry said he thought standards in America were developed by the National Bureau of Standards. When shown a recent statement by the Bureau that it had representation on 408 committees of ASTM, he became very interested in our methods and organization.

There were many other similar questions, some quite amusing. I believe, however, that it is fair to say that we do need some better communication with many groups affected by our work, but not directly concerned. Steps to develop greater understanding of our operation are being taken.

ASTM and the Government

As indicated by the questions of those outside our borders, the relationship of ASTM to Government standardization, and to other professional and standardizing bodies in the United States is hard for them to understand. Our system of standardization is inherently tied to our system of free enterprise. It is a completely voluntary system, in which our Government may have representatives on committees, often acting as chairmen, and as at present, in our Society, members of government agencies serve on our Board of Directors. As a most important customer, the Government's representatives have great weight, but the Government does not try to dominate our work nor that of any other standardizing group on which it has representation.

It is also a fact that no single agency acts for the Government.

Although as far as we know, there is no single agency established on a national level to coordinate the needs of the Federal Government with those of industry as far as standards are concerned, ASTM has for many years, in fact, from its very inception, cooperated closely with those Governmental agencies that develop standards.

For many years we have had a Government Contacts Committee, and many of our committees have contact liaison with governmental departments, cooperating with Federal agencies such as General Services Administration and the Department of Defense, to avoid duplication and to obtain a better coordination between Government and industry standards.

An outstanding example of this kind of accomplishment is Federal Standard 791, which now merely refers by ASTM designation to about 90 test methods for petroleum products and lubricants. These were developed by our Committee D-2. In addition, our Committees on Plastics, Paints, Steel, Textiles, and Cement are actively

[1] R. A. Schatzel, "Where Do We Go from Here?," ASTM BULLETIN, No. 217, October, 1956, p. 21.

helping to coordinate Federal and ASTM Standards. We also have a contract with the GSA to supply our ASTM Standards to the Government.

When we realize the great savings these programs effect in cost and manpower during peacetime, and the fact that time will not be available during an emergency for their development, this cooperative effort represents both a patriotic and an economic accomplishment for intelligent constructive cooperation—particularly on the part of our Government.

There are many similar examples, in other fields, of cooperation.

ASTM and Other Societies

In our relations with other professional and technical associations we are equally fortunate. In the field of standardization the American Society for Testing Materials is the oldest, in existence before the Bureau of Standards was organized, and one of the sponsors and organizers of the American Standards Assn. in 1918. It is not surprising, therefore, that approximately 250 technical societies and trade associations have representation on our technical committees. We also have formed a great many joint committees with other associations to conduct research with highly specialized groups in a particular field of scientific endeavor. This combination of skills and organizations results in a more rapid absorption of scientific research into an organized body of knowledge and the creation of new technologies as a contribution to our economy. The strength of ASTM derives from the fact that it serves the intelligent self interest of industry, Government and the consuming public.

Occasionally, a trade association or other group may find an apparent duplication of their efforts in our committees' work but more often they will bring the results of their work to our committees to subject them to the broader scrutiny of the consumer and general interests which are represented on all our committees. When duplication is found, it is either resolved by our appropriate Administrative Committee or by the formation of a Joint Committee.

There is one important guiding principle in all our work. Our committees are autonomous within their scope. Only when there is an expressed request to the committee and approval by the Society of its need, is a new field of endeavor considered. Only then when it does not duplicate the work of some other well qualified group, is the work authorized. Manpower and the tremendous needs of our technological development dictate cooperation rather than competition.

Since many organizations develop standards of various kinds and promulgate codes, there is a need for a voluntary central clearing house, so that in international standardization there is a unified American voice. This is the function of the American Standards Assn. Approximately one-third of the standards of ASA are the responsibility of ASTM. This is an example of teamwork and the avoidance of duplication to conserve technical manpower.

The Job Ahead

What of the job ahead; and how are we prepared to cope with it? Standardization is the result of research, and as one of our Directors has so aptly said, "Research is what makes our standards dynamic," moving and growing as new knowledge is developed. Standards, then, are the vehicle by which new scientific knowledge and its applications are assimilated in an orderly manner into our economy.

In 1955 Dr. Vannevar Bush, who headed the office of Scientific Research and Development during wartime, testified as follows:

> But it would be a mistake to assume that the greatest result of the war from the standpoint of . . . application of science . . . lies in the appearance of . . . automation . . . we have new fibers, new plastics, and as a result a whole new industry. We have thermionic tubes, transistors, phosphors, and their application in radio, radar, television, and many other devices We have greatly extended synthetic chemistry . . . we have atomic power in the offing, and we may also have solar power . . . what is new is an accelerated pace in the application of scientific results in an economic manner.

We could also add that another new factor is the ready acceptance by the public of these techniques and materials. There is a noticeable quickening of pace—a lessening in the induction period from laboratory experiment to commercial channels that has resulted in the development of whole new industries which have a vested interest in change, of which automation is an example. In addition, we have new environments of vital importance. Among these are radiation, aerodynamic heating, high-intensity sound, broadband shock and vibration, and combinations of these. We must have reliable data and methods of evaluation of the performance of materials under these new conditions. The cooperative resources of both industry and Government are necessary to provide the answers. Our Society has a most important part to play, and time is of the essence.

In addition to unusual applications and services, it is astounding to think of the volume of uses anticipated for some of our more prosaic materials. These also require sound standards. Our Vice-President, Kenneth Woods, who is chairman of the Highway Research Board, points out that the Bureau of Public Roads estimates that 49 million tons of steel, 1 billion, 339 million barrels of cement, 128 million tons of bituminous material, and large quantities of other construction materials will be needed in the Federal highway construction program. On the New Jersey Turnpike alone, over 100 ASTM Standards were involved in the materials used. Whether for unique application or for large volume use, ASTM standards are an effective factor in purchase and control.

Many of our committees are already concerned with phases of these and other problems which mark the explosion of our technological progress. A detailed listing of our new committees, formed each year, and the number and diversity of the symposia held at each of our Annual and Spring meetings, catalog much of this progress.

ASTM Plans for the Future

Is ASTM prepared to play its part in this expanding development of scientific knowledge and technological advance? The rapid growth of ASTM measured by membership, standards, publications, and sound finance is a clear indication that the Society is more than keeping pace with the technological revolutions that are taking place in this country and the world at large. The sound and orderly growth of our Society is due to its contributions to our economy and technology in the past. A major problem of the future is to assure that these proliferations do not weaken our capacity for service and sound guidance, and that they are organized so that the work of the Society will continue at a high efficiency. To this end, a planning committee to examine the organization, procedures and operation of the Society has been authorized and is being formed. We cannot plan for the next sixty years or for the year 1999, but we can be assured that ASTM is prepared to continue the service to our industry and our country, which has typified its past.

In closing, may I again express my sincere appreciation to all the members of the Board who have served with me and to all of our wonderful Staff for their loyalty to the Society—and to you, for the great honor you have done me. I know that the same support is assured our new President in the year of progress which is immediately before us. As I take my place in the rank I do so with a profound sense of gratitude and of confidence in our Society's future.

Controlled Moisture Condensation Apparatus for

Evaluation of Rust-Preventive Oils

By H. RODEN

Comparative tests with a closed-cell, high humidity, moisture condensation apparatus which provides specific temperature differences between humid ambient air and steel surface, showed it to be a faster, more reproducible method

Box-type humidity cabinet tests are included in Government specifications, and such cabinets are widely used by commercial and industrial laboratories for evaluation of several types of rust preventive compounds and preservative lubricating oils. Such tests are used to measure the protectiveness of oils and compounds after application to flat steel specimens which are then subjected to high humidity and moisture condensation at 100 or 120 F for specified periods of time or until rusting occurs.

The unsatisfactory features of the box-type cabinet are that reproducibility is low and testing time excessive, especially for commercial products which require preshipment test and approval.

Several years experience with the box-type cabinet described by U. S. Army Specification 2-126[1] indicated that lack of uniform moisture condensation on the steel test surface was mainly, but not solely, responsible for unsatisfactory results. Although data are not presented, it is generally the experience that none of the later modifications of the cabinet type equipment, such as the early Precision cabinet[2] or the later ones specified by Military Specifications AN-H-3[3] or JAN-H-792[4], provide for moisture condensation control, or offer better reproducibility. There are no data available that correlate this kind of corrosion testing with specific rates of moisture condensation. Since actual service conditions cover all degrees of moisture condensation at temperature levels within the atmospheric range, any laboratory test conditions that might be correlated with a certain service performance would not necessarily be usable to determine the protection of a product at other temperature levels and moisture conditions.

The general objective of this investigation was to develop equipment that would provide improved reproducibility over that obtained by the box-type cabinet; the specific objective was to control moisture condensation on the test specimens.

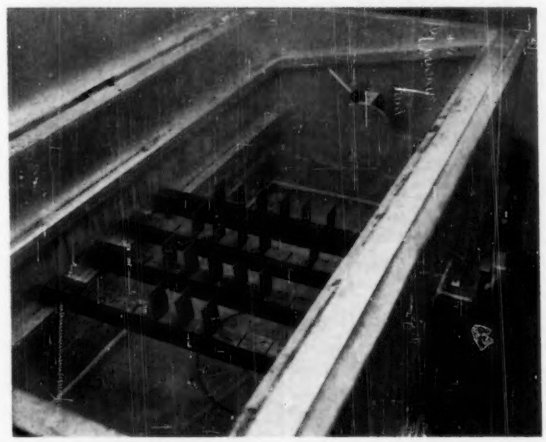

Fig. 1.—Interior view of box-type humidity cabinet with cover raised to show test panels in position. Sloping glass cover removed.

Equipment and Procedures

Box-Type Cabinet

Specifications for the cabinet, its operation, and test procedure were in accordance with U. S. Army Specification 2-126. Figure 1 shows the interior view of the cabinet used.

Closed-Cell Apparatus

A 20 unit closed-cell apparatus was built by The Texas Company at Port Neches Research Laboratory. The apparatus can be operated over a relatively wide range of temperature with corresponding ranges of tempera-

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NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to ASTM Headquarters, 1916 Race St., Philadelphia 3, Pa.

[1] U. S. Army Specification 2-126, Oil, Engine Preservative (6 Aug., 1946). This specification is obsolete as it was superseded by Military Specification MIL-L-21260, Lubricating Oil, Internal Combustion Engine, Preservative (8 Feb., 1954).

Copies of these specifications can be obtained from the Office, Chief of Ordnance, War Dept., Washington 25, D. C.

[2] Precision Scientific Co. humidity cabinet (prior to CRC modification in 1944).

[3] Army-Navy Aeronautical Specification AN-H-31, Operation of Humidity Cabinets (2 Apr., 1945).

[4] National Military Establishment Specification JAN-H-792, Operation of Humidity Cabinet (21 June, 1949).

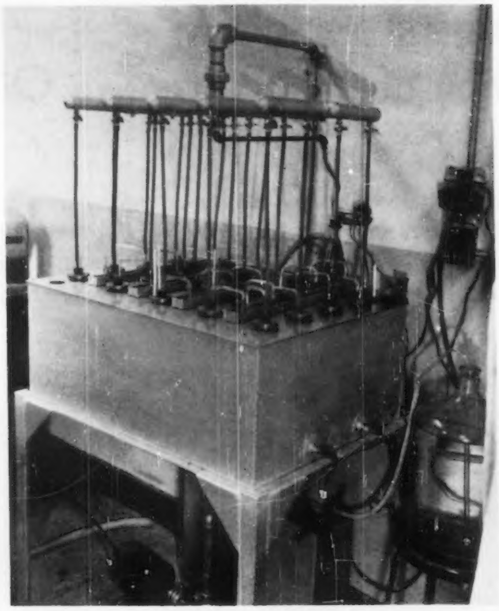

Fig. 2.—General view of closed-cell equipment.

ture difference between the steel test specimen and the humid ambient air.

The equipment, further described in Appendix I, consisted of: (*a*) a thermoregulated water bath with a perforated cover to hold the glass cells in a vertical position; (*b*) a 25-gal thermoregulated water tank and a pump to circulate water continuously at the desired temperature through the hollow, cylindrical specimens; and (*c*) twenty glass cells, each containing a 0.75 in. diameter by 6-in. long black-iron pipe nipple screwed into a cover cap and closed at the lower end. Each cell assembly is immersed in the water bath, which is held at the desired temperature level. Water at a lower temperature flows through each nipple and is drained back to the thermoregulated tank. Figure 2 shows a general view of the apparatus; Fig. 3 is a view of the cells partly removed from the bath; Fig. 4 is a detail sketch of the entire apparatus, and Fig. 5 is a detail sketch of the cell assembly.

Typical Data for the Box Type Humidity Cabinet at 100 F

Statistical Data for 81 Oils

Prior to the development of the closed-cell apparatus, a study of the reproducibility of tests for the box-type humidity cabinet was made. These results had been obtained from 81 different preservative oils of SAE 10 and 30 grade over a period of several months. For all tests, four specimens were used, instead of the specified two, to obtain better statistical values. The criterion of failure was the number of hours for the appearance of at least three points of rust within the significant area of both sides of the 2 by 3 by 0.06-in steel specimen (0.125-in. border excluded). This study showed that reproducibility was very poor, as the standard deviation averaged 149 hr, ranging from 0 to 481 hr, from a grand average failure time of 410 hr. The corresponding coefficients of variation averaged 38 per cent, ranging from 0 to 96 per cent. The time required to complete a test depended on the protectiveness of each oil, but generally excessive, as some of failure times approached 1300 hr.

Statistical Data for One Oil

One oil was applied to 20 specimens which were tested in the box-type cabinet at 100 F as follows:

Twenty 2 by 3 by 0.06-in. sandblasted steel specimens were coated with a preservative oil SAE 10. Ten specimens were placed in each of two of the specified slotted wooden blocks and both blocks placed in the cabinet, one block at 18 in. from either end of the 60-in. inside length cabinet. Failure times in hours for each specimen were as shown in Table I.

TABLE I.—HOURS TO FAILURE ACCORDING TO POSITION IN HUMIDITY CABINET. BACK WALL OF CABINET.

Back Wall of Cabinet

	168	312	
	408	480	
	48[a]	336	
Air	24[a]	312	Air
Outlet	480	312	Inlet
←	504	504	←
	312	336	
	336	408	
	312	480	
	312	336	

Front Wall of Cabinet

[a] Omitted from statistical consideration because such low values indicate faulty specimens resulting from surface imperfections, contamination, or other uncontrollable variables.

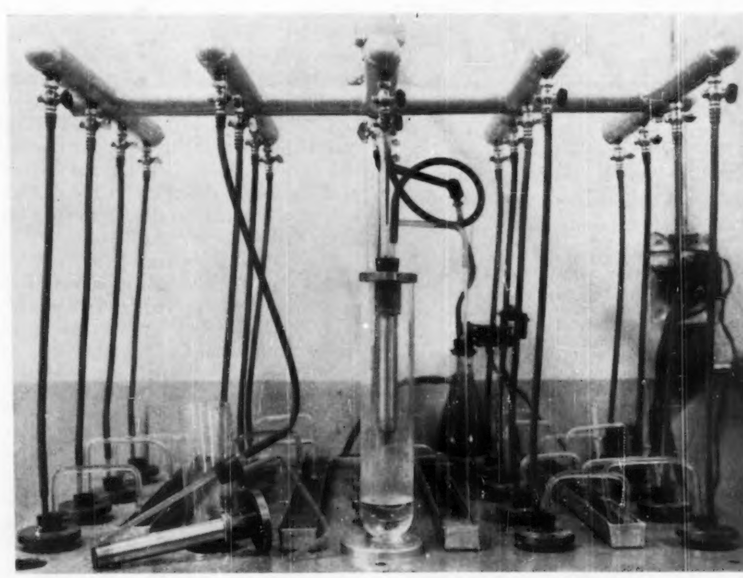

Fig. 3.—Detail view of closed-cell and specimen assembly.

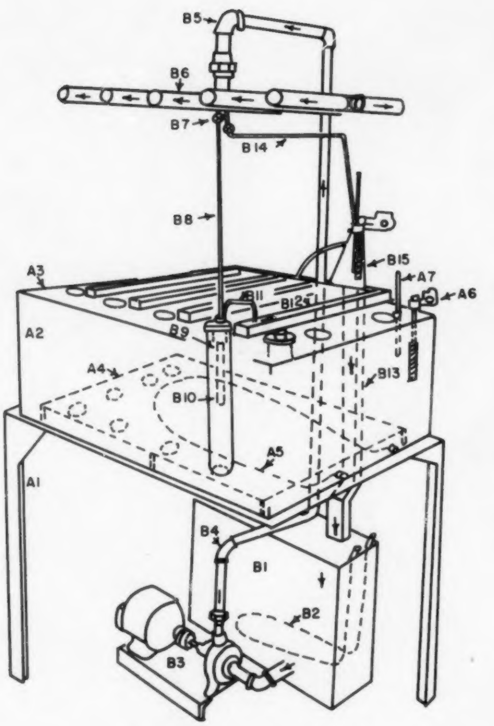

Fig. 4.—Closed-cell equipment.

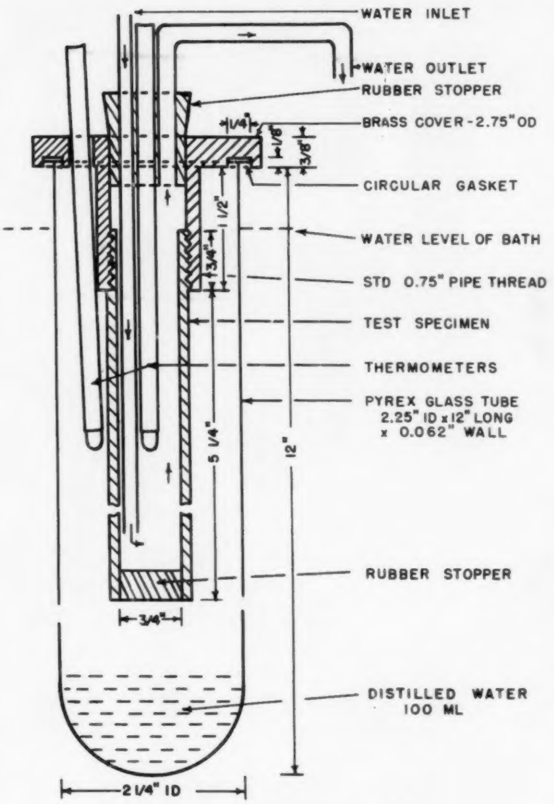

Fig. 5.—Detail of closed cell.

Results for different[5] cross-sectional areas of the cabinet were not statistically significant as the standard deviations ranged from 72 to 101 hr; the coefficients of variation ranged from 19 to 28 per cent from the average failure time of 369 hr.

From experience with humidity cabinet operation it appears that a major variation results from the daily opening and removal of the specimens for inspection. The resultant cooling of the specimens, when removed to a room temperature of 77 F for a few minutes' inspection, increased moisture condensation on them when they were returned to the 100 F cabinet for continuation of test.

Effect of Different Gradings of Sand

Different degrees of surface roughness of the test specimens appeared to cause variations of an oil's protectiveness, probably because of the variable amounts of oil retained in the minute surface pits. The protectiveness of the oil thus becomes dependent on the finish of the specimen. This hypothesis was investigated using two oils applied to steel specimens that had been blasted with five, increasingly finer, grades of sand. Data in Table II show that there was no significant difference in reproducibility (as measured by the standard deviations) which could be attributed to the different gradings of sand. The data show a reduction in average hours durability of the oils as increasingly fine sands, of less than No. 40 sieve grading, were used. Determinations of the specific roughness of steel specimens resulting from preparation with these sands were not made. However, profilometer measurements covering several degrees of roughness resulting from specimen preparation with different grit abrasive surfacer belts, fine polishing, and blasting with the grade of sand specified by U. S. Army Specification 2-126 are shown in Table III.

Experiments with Closed-Cell Apparatus

Operation at Different Temperatures

Four sets of tests were made at different temperature conditions, using 14 different preservative lubricating oils of SAE 10 grade, to observe the relative amounts of moisture condensation on the hollow cylindrical specimens. The protectiveness of the oils was not under consideration. Duplicate nipple specimens, having one-half (lengthwise) of the cylindrical surface ground and the other half sandblasted, were used for each oil. Temperature conditions were as shown in Table IV.

Condensation behaviors are described. Results of tests are shown in Table V.

Set No. 1.—With moisture-saturated ambient air at 100 F and the metal surface temperature at 80 F, a heavy precipitate of water occurred immediately on the oil-coated test nipples. Oil No. 1, a nonadditive, high viscosity-index, paraffin-base lubricating oil failed within 15 min as evidenced by a complete thin layer of brown rust; oil No. 11, a multiple-additive oil averaged 95 hr. The heavy condensation produced a surface washing action similar to that resulting from very light rainfall, the inside steaming of window panes during cold weather, dense fog, or heavy dew. It was believed that for most test purposes too much water was precipitated by the 20 F temperature difference. For

[5] Right and left halves; front and back halves.

TABLE II.—EFFECT OF SAND GRADING ON DURABILITY OF OILS.[a]

Specimen	Hours to Failure. 100 F Box-Type Humidity Cabinet, 95 to 100 per cent Relative Humidity. Duplicate Steel Specimens Sandblasted with Ottawa Silica Sand.									
	Sand A		Sand B		Sand C		Sand D		Sand E	
	Hours to Failure, Individual Oils									
	Oil No. 1[a]	Oil No. 2[a]	Oil No. 1	Oil No. 2	Oil No. 1	Oil No. 2	Oil No. 1	Oil No. 2	Oil No. 1	Oil No. 2
No. 1	240	192	518	518	96	552	360	360	96	432
No. 2	432	432	532	648	432	696	552	480	144	432
Average	336	312	525	583	264	624	456	420	120	432
	Hours to Failure, Both Oils									
Average	324		554		444		438		276	
Standard deviation, hr	109		43		221		82		157	
Coefficient of variation, per cent	33.6		7.8		49.8		18.7		56.8	

SIEVE GRADING OF SANDS USED

Sieve Size		Sieve Grading, per cent				
Passing	Retained on	Sand A	Sand B	Sand C	Sand D	Sand E
	No. 10	0.1	...	...	...	...
No. 10	No. 20	37.5	0.1	...	...	...
No. 20	No. 30	62.1	0.9	...	...	...
No. 30	No. 40	0.3	98.7	0.1	...	...
No. 40	No. 50	...	0.3	8.2	0.1	...
No. 50	No. 60	...	...	70.1	8.6	...
No. 60	No. 70	...	...	21.1	69.2	...
No. 70	No. 80	...	...	0.5	20.6	0.4
No. 80	No. 100	...	...	...	1.5	0.3
No. 100	No. 200	...	...	...	...	93.0
No. 200		...	...	...	...	6.3

[a] Oil No. 1—fair protectiveness, SAE 30. Oil No. 2—good protectiveness, SAE 30.

TABLE III.—METAL FINISH—PROFILOMETER MEASUREMENTS OF SURFACE ROUGHNESS (TYPE 1020, DEAD SOFT, FLAT, STEEL PLATE).

Method	Grit	Average (rms), microinch	Maximum, Peak to Valley, microinch
Belt Surfacer	50	107 to 127	740 to 750
Belt Surfacer	120	22 to 33	180 to 270
Belt Surfacer	240	9.8 to 12.4	80 to 130
Belt Surfacer	320	9.9 to 10.0	85 to 108
Hand Polish	400A	2.6 to 2.9	22 to 24
Hand Polish	000	1.6 to 1.8	12 to 13
Sandblast	[a]	115 to 126	800 to 900

[a] Flintshot Ottawa Silica Sand as specified in U. S. Army Specification 2-126.[1]

TABLE IV.—TEMPERATURE CONDITIONS FOR OPERATION OF CLOSED-CELL APPARATUS.

Set	Ambient Air, deg Fahr	Metal Surface, deg Fahr[a]	Temperature Difference, deg Fahr
No. 1	100	80	−20
No. 2	100	97	− 3
No. 3	100	103	+ 3
No. 4	115	100	−15

[a] Temperature of water circulating through test nipple.

evaluative work it is desirable to observe slight differences in protection durability afforded by each oil. At a temperature difference of 20 F, only those oils of relatively high protectiveness were distinguishable. The rapid failure induced by heavy moisture condensation resulted in loss of distinction for oils of low durability.

Set No. 2.—The decreased temperature difference (3 F between the ambient air and the metal surface) resulted in greater distinction for time of rust formation for oils of both high and low protection characteristics. The failure times for all oils, both sandblasted and ground surfaces, averaged about eight times longer than when the 20 F temperature difference was used.

Set No. 3.—Theoretically, with moisture-saturated ambient air at 100 F and a metal surface temperature of 103 F, there should be no moisture condensation on the specimens and none was evident. Testing time was excessive as half of the tests were incomplete at 1032 hr when they were discontinued. Only those oils of low durability were distinguished by the high-humidity, no condensation conditions after the prolonged test period.

For several specimens, the sandblasted surfaces failed first, which was unusual. From this behavior, and their brown-black peppered appearance, it was evident that surface roughness was a factor for initiating rust formation under this test condition. As the pretest drainage period of the oil-coated test cylinders was ample for the oil film at the minute projecting "peaks" of steel of the sandblasted surface to drain completely, it was assumed that moisture vapor was adsorbed at these minute peaks.

The ground surfaces comparable with the peppered sandblasted failures lasted considerably longer. This was considered to be the result of greater continuity and uniformity of the oil film because of the smoother metal surface.

Set No. 4.—The conditions of moisture saturated air at 115 F and metal surface temperature of 100 F demonstrated the effect of increasing the temperature level of the test but maintaining a temperature difference approximately the same as for set No. 1. The 15 F temperature difference precipitated a relatively large amount of water on the oil-coated specimens which resulted in a "washing" action and relatively fast failures of the less protective oils. The over-all average failure time for the 115 F temperature level produced rusting of ground surfaces about 20 per cent faster than 100 F ambient air and 80 F metal temperature. This is not a significant difference of testing time. For sandblasted surfaces, the failure times at temperature levels of 100 and 115 F were practically the same. Based on these tests there appears to be no advantage in testing

TABLE V.—ORIGINAL DATA FOR OPERATION OF CLOSED-CELL APPARATUS AT DIFFERENT TEMPERATURES.

Oil Sample	Hours to Failure														
	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	No. 13	No. 14	Average
SET NO. 1—100 F AMBIENT AIR; 80 F METAL SURFACE TEMPERATURE.															
Ground[a] Specimen															
No. 1	0.25	24	1	22	2	2	1	24	70	22	70	46	22	22	
No. 2	0.25	8	1	46	2	2	1	24	70	96	120	96	22	22	
Average	0.25	16	1	34	2	2	1	24	70	59	95	71	22	22	29.9
Sandblast[b] Specimen															
No. 1	0.25	24	24	2	2	2	24	24	70	46	70	46	22	46	
No. 2	0.25	24	24	2	2	2	24	24	70	46	96	96	46	46	
Average	0.25	24	24	2	2	2	24	24	70	46	83	71	34	46	32.3
SET NO. 2—100 F AMBIENT AIR; 97 F METAL SURFACE TEMPERATURE.															
Ground Specimen															
No. 1	30	30	30	72	30	30	30	96	144	672	504	240	72	240	
No. 2	30	30	30	120	48	30	48	96	672	672	600	240	72	312	
Average	30	30	30	96	39	30	39	96	408	672	552	240	72	276	186.4
Sandblast Specimen															
No. 1	30	30	6	120	30	30	30	120	672	744	600	504	24	744	
No. 2	30	30	30	240	30	30	30	672	672	744	744	600	216	744	
Average	30	30	18	180	30	30	30	396	672	744	672	552	120	744	303.4
SET NO. 3—100 F AMBIENT AIR; 103 F METAL SURFACE TEMPERATURE.															
Ground specimen															
No. 1	168	168	216	936	936	216	816	[c]	[c]	[c]	[c]	[c]	[c]	[c]	
No. 2	168	168	216	[c]	1032	216	816								
Average	168	168	216	936	+984	216	816								...
Sandblast Specimen															
No. 1	24	24	216	336	264	96	120	[c]	[c]	[c]	[c]	[c]	[c]	[c]	
No. 2	24	24	216	408	648	96	120								
Average	24	24	216	372	456	96	120								...
SET NO. 4—115 F AMBIENT AIR; 100 F METAL SURFACE TEMPERATURE.															
Ground Specimen															
No. 1	0.25	0.25	0.25	3	0.25	3	0.25	24	48	72	48	7	24	7	
No. 2	0.25	0.25	0.25	3	0.25	7	3	24	48	144	120	24	24	48	
Average	0.25	0.25	0.25	3	0.25	5	1.6	24	48	108	84	15	24	27	24.3
Sandblast Specimen															
No. 1	0.25	0.25	0.25	24	3	3	3	48	72	72	48	48	3	48	
No. 2	0.25	0.25	0.25	48	3	3	3	48	144	72	120	48	7	48	
Average	0.25	0.25	0.25	36	3	3	3	48	108	72	84	48	5	48	32.8

[a] Belt surfacer using 120 grit belt = 22 to 33 microinch surface roughness.
[b] Flintshot sand = 115 to 126 microinch surface roughness.
[c] Specimens not failed at 1032 hr when test discontinued.

at 115 F instead of 100 F ambient air temperature, as the average time of test was not reduced enough to be worthwhile, and the lack of distinction for oils of low durability was still present.

These four preliminary sets of tests demonstrated the effects of different degrees of moisture condensation on rates of failure of specimens. For either extreme of condensation there was a loss of distinction of oil protectiveness, very heavy condensation revealing oils of high protectiveness while very light condensation increased the relative durability of oils of low protectiveness. From these results it is evident that for any degree of moisture condensation selected, it must be maintained constant to obtain reproducible results.

Moisture Condensation Measurements

The closed-cell equipment was operated at different ambient air and metal surface (circulating water) temperature to approximate the amounts of water condensed on a specimen. This was done by placing a small wide-mouth jar inside the closed-cell[6] beneath the test nipple, which was thinly greased so that condensed water would drain off, operating the equipment for 24 hr at the desired temperature with a circulating water volume of 400 ml per min, removing the jar and measuring the volume of water collected. From the duration of the collection period, the volume of water collected, and the area of the exposed metal,[6] the rates of condensation shown in Table VI were obtained.

[6] The net air space of the closed-cell with test nipple in place is 625 ml. Exposed area of the nipple is approximately 22 sq in.

TABLE VI.—RATES OF MOISTURE CONDENSATION.

Ambient Air, deg Fahr	Metal Surface,[a] deg Fahr	Temperature Difference, deg Fahr	Water Collected,[b] ml per sq in per hr
100	85.4	14.6	0.0198
100	95.0	5.0	0.0046
100	100.0	0.0	0.0000
115	100.0	15.0	0.0302

[a] Temperature of water circulating through the test nipple.
[b] Average of 4 determinations.

Water collected at the ambient air temperature of 115 F was about 1.6 times the amount at 100 F. The greater deposition of liquid water from the vapor state at 115 F results from the greater water vapor content of saturated air at the higher temperature. The water vapor content of saturated air at 115 F is 1.66 times as much as at 100 F. The amount of water precipitated at 100 F, by increasing the temperature difference between ambient air and metal surface temperature, is an empirical relation dependent on equipment design and operation.

Comparison of Results with Two Types of Apparatus

Three comparable sets of tests at 100 F were made using both types of equipment. Eight preservative lubricating oils of SAE 10 and 30 grade were used.

For tests with the box-type cabinet the procedure and equipment specified by U. S. Army Specification 2-126[1] were used. However in each set four speci-

TABLE VII.—SUMMARY OF RESULTS FOR BOX-TYPE CABINET AND CLOSED CELL EQUIPMENT.

Oil	100 F Box-Type Cabinet Sandblasted Specimens				Closed Cell 100 F Ambient Air, 90 F Metal Temperature							
					Sandblasted Specimens				Ground Specimens			
	Number of Tests	Average, hr	Standard Deviation, hr	Coefficient of Variation, per cent	Number of Tests	Average, hr	Standard Deviation, hr	Coefficient of Variation, per cent	Number of Tests	Average, hr	Standard Deviation, hr	Coefficient of Variation, per cent
No. 1	12	338	237	70.2	10	110	68	61.8	11	70	19	27.3
No. 2.....	12	812	449	55.3	10	206	55	26.7	11	142	34	23.9
No. 3.....	12	264	163	61.7	11	94	31	33.5	11	33	12	32.1
No. 4.....	12	604	391	64.8	11	205	73	35.5	11	96	49	51.0
No. 5.....	12	402	269	67.0	10	146	35	23.8	10	77	26	32.6
No. 6.....	12	847	480	56.7	10	216	70	32.6	10	151	89	59.1
No. 7.....	12	358	279	77.9	10	120	40	33.4	10	53	21	39.6
No. 8.....	12	790	283	35.8	10	170	51	30.0	10	137	83	60.8
Average (rms)........		552[a]	335	62.3		158[a]	55	36.4		94[a]	50	43.0
Test time ratio.....		1.0				0.29				0.17		

[a] Mean values.

TABLE VIII.—PERFORMANCE RATINGS FOR THE OILS.

Oil	Box-Type Cabinet Sandblast	Closed-Cell	
		Sandblast	Ground
No. 1..	7th[a]	7th	6th
No. 2..	2nd	2nd	2nd
No. 3..	8th	8th	8th
No. 4..	4th	3rd	4th
No. 5..	5th	5th	5th
No. 6..	1st	1st	1st
No. 7.	6th	6th	7th
No. 8..	3rd	4th	3rd

[a] Numerical order of average failure times for 3 sets of tests. 1st, Best of group. 8th, Worst of group.

mens were tested instead of two, as specified, to obtain better statistical values.

For the closed-cell, ambient air at 100 F was used. A 10 F temperature difference was selected to produce an intermediate amount of moisture condensation, as earlier work had shown that a metal surface temperature at 80 F (20 F difference) precipitated a considerable amount of water, whereas a temperature of 97 F (3 F difference) produced a relatively small amount.

The criterion of failure of specimens for both procedures was the number of hours when at least three points of rust could be identified.[7] For both types of equipment an adherent film of emulsified oil covered part of the specimen for lengthy periods, but observations were continued until corrosion was apparent. Specimens were observed during the first and eighth hours and once every 24-hr period thereafter. Summarized data are shown in Table VII.

Deviations from Average Failure Time

Summarized data in Table VII show that tests in the closed-cell equipment had lower coefficients of variations than for the box-type cabinet. The average coefficient of variation was 62 per cent for the sandblasted specimens in the cabinet. For the closed-cell the coefficients were 36 per cent for sandblasted and 43 per cent for ground specimens. These values reveal the considerable improvement in reproducibility of the closed-cell equipment over the box-type equipment. Although improved reproducibility was achieved, further improvement is desirable. The difference between the standard deviations for sandblasted and ground specimens tested in the closed-cell is not statistically significant.

Testing Time

The average duration of test for the eight oils was reduced from 552 hr for the cabinet to 158 and 94 hr (sandblast and ground surfaces, respectively) for the closed-cell equipment. This reduction amounts to 29 per cent and 17 per cent of the cabinet test time. Ratios are shown in Table VII.

Temperature Control

There was adequate control ($\pm$1 to 1.5 F), of all temperature conditions at all times during all tests. The cabinet and closed-cell equipment were located in a constant temperature room at 75 to 79 F and 45 to 55 per cent relative humidity. However, for the cabinet equipment there can be no positive difference of temperature between the surface of the flat specimen and the ambient air. For closed-cell specimens a difference of 10 F was maintained.

Performance Ratings for the Oil Series

Protection ratings based on the total of the average failure times, for the three sets of tests, for each oil, by each procedure, are shown in Table VIII. On a comparable basis the sandblasted specimens in the box-type cabinet, and either sandblasted or ground specimens for the closed-cell equipment, gave each of the eight oils almost identical ratings.

Discussion

There is no specification in effect nor has any procedure become established for testing rust preventive compounds and preservative oils that covers the amount or rate of moisture condensation on the surface of the specimen. In U. S. Army Specification 2-126,[1] the amount of moisture condensation specifically mentioned is "... during the test there shall be definite evidence of moisture condensation on the test panels." This condition is usually fulfilled within a few hours after panels are placed in the humidity cabinet; thereafter the rate of moisture condensation is not constant as there is no temperature differential between the saturated ambient air and the flat steel specimen. Provision for this essential feature will have to be a part of any standardization program. The amount of condensation is extremely important but apparently the users of the test are uncertain or unaware as to which condition—low or high moisture condensation—is most desirable. It is possible, if improved equipment were available, that different but specific degrees of condensation could be used to meet the needs for testing different protective oils and other products under conditions approaching actual service.

Another important variable in the evaluation of rust prevention of oils against high humidity and moisture condensation is the thickness of the oil film retained on the metal surface. There are many factors affecting the thickness, such as vertical or sloping position of the metal surface, roughness or smoothness of the surface, time and temperature of drainage, and viscosity index of the oil. Past work at this laboratory has demonstrated the effects of most of these factors; the metal roughness (such as for a sandblasted surface) being one of the most variable because of its ability to retain oil.

There is definite need for revision and

[7] A 5$\times$ magnifocuser was used as a visual aid.

standardization of the procedure for preparation of test specimens, especially for the metal surface finish. Present data show that ground surfaces offer equal distinction of oil durability and a greater possibility for reduction of testing time. Inasmuch as the ground surfaces of test specimens would be more comparable to the finished surfaces of motor cylinders, etc., than are sandblasted surfaces this would appear to be a desirable finish to adopt as standard. However, the preparation and finish of test specimens should be further investigated before standardization. Further investigation of the problem is not planned by this laboratory.

Conclusions

It is concluded that:

1. The protection test specified by U. S. Army Specification 2-126[1] is not satisfactory because of low reproducibility and excessive testing time. This appears to be due to lack of control of the rate of moisture condensation on the test specimens.
2. The closed-cell equipment gives better reproducibility and faster testing time than the box-type cabinet because the selected rate of moisture condensation can be maintained.
3. The closed-cell equipment shortened the test time to one fourth or one sixth of the time, depending on specimen preparation and surface roughness, required for the cabinet.
4. Performance ratings for typical oils obtained with the closed-cell equipment correlate very well with those for the box-type humidity cabinet.
5. The closed-cell equipment offers greater flexibility of operating conditions, of temperature level, and of rate of moisture condensation.
6. A ground finish for specimens is preferable to a sandblasted finish because (*a*) ground surfaces are most representative of surfaces to be protected than are sandblasted surfaces; and (*b*) shorter testing time is possible.
7. Further improvements in reproducibility through definition and standardization of all test conditions is highly desirable.

Acknowledgment:

The author is indebted to R. F. Huhndorff of The Texas Company, Port Arthur Research Laboratory, for assistance in statistical calculations.

APPENDIX I

The closed-cell equipment is covered more fully in the following detail of construction and operation.

Description of Equipment[8]

Waterbath Assembly

A1.....Stand—$\frac{1}{4}$-in. sheet iron top, 40 by 30 by $\frac{3}{4}$-in. angle iron legs.

A2.....Bath—$\frac{1}{8}$-in. sheet iron, welded; 37 by 27 by 14.5 in.

A3.....Cover—$\frac{1}{8}$-in. sheet iron, bolted to bath; size 37.5 by 27.5 in., twenty $2\frac{9}{16}$-in. openings for glass tubes.

A4.....Seating plate—$\frac{1}{8}$-in. sheet iron; 34 by 24 in.; twenty 1.5-in. openings to seat glass tubes.

A5.....Heating element—500 w; water immersed, controlled by A6.

A6.....Thermoregulator—Am. Instrument Co., special rotating contact point (to relay).

A7.....Thermometer—of suitable range, reading to 0.2 F per division.

Circulating Water System

B1.....Circulating and heating tank—size 24 by 8 by 18 in., $\frac{1}{8}$-in. sheet iron, welded.

B2.....Heating element—1000 w, water immersed, controlled by B15.

B3.....Motor driven centrifugal pump—$\frac{1}{4}$-hp motor, 1725 rpm; Cherry-Burrel Corp. pump.

B4.....$\frac{3}{4}$-in. galvanized iron pipe.

B5.....1.5-in. galvanized pipe and fittings.

B6.....Distributing manifold—1-in. welded galvanized iron pipe.

B7.....Water volume control cock—Male, $\frac{3}{16}$-in. bore.

B8.....$\frac{1}{4}$-in. rubber tubing.

B9.....$\frac{3}{16}$-in. ID water inlet tube—glass.

B10....Test specimen.

B11....$\frac{3}{16}$-in. ID water outlet tube—glass.

B12....Troughs for outlet water—$1\frac{3}{4}$ by 1-in. galvanized iron.

B13....Drainspout from troughs to circulating and heating tank.

B14....Circulating water to temperature control flask.

B15....Temperature control flask containing thermometer and thermoregulator (to relay).

[8] Subscripts refer to detail of Fig. 4.

[9] To be comparable with the practice of Rock Island Arsenal at that time.

Procedure

Preparation of specimens (combined sandblasted and ground finish):—The pipe nipples, cover cap, and rubber stopper to close the lower end of the nipple are assembled using Cenco label varnish to prevent water leaks. After assembly, the nipples are washed with naphtha and air dried. The entire surface of the nipple is ground on a motordriven, flat, belt-surfacer using 50, 80, and 120 grit belts consecutively. After grinding to 120 grit finish, one half of the lengthwise cylindrical area is sandblasted with Ottawa Flintshot sand, a close-fitting iron shield being used to protect the one half of the previously ground surface. After sandblasting, the cylinder is freed of dust by blowing with a net of filtered air.[9] Cylinders are prepared and used the same day, if necessary storing them in an oven at 130 F until ready for use. Avoid touching the test surface or allowing it to become damp. Before dipping in oil the cylinders are brought to 77 F in a constant temperature room at 50 per cent relative humidity.

Oil to be tested is brought to 77 F and poured into a cut-off 500-ml glass graduate $1\frac{13}{16}$ in. diameter by 7 in. deep, any bubbles allowed to rise, and the test cylinder immersed without agitation for 1 min. After withdrawal the cylinder is placed vertically in a wooden rack and drained 16 to 20 hr at 77 F. After drainage, excess oil is wiped from the bottom and the cylinder assembly is ready to be placed in the glass cell.

Adjustment of Waterbath and Circulating Water

The bath and cooling water systems are brought to the desired operating temperatures before specimens are placed in it. Adjust the circulating cooling water at each manifold cock to approximately 400 ml per min. About $\frac{1}{2}$ hr before placing the test cylinders in the glass tubes, pour 100 ml of distilled water into each glass cell. Place the test cylinders in the glass cells, insert the rubber stopper (through which the circulating water passes into and out of the test cylinders) into the brass cover and seat the glass cells in the water bath. Make final adjustments of the circulating water to 400 ± 10 ml per min. Place bulb of ambient air thermometer within $\frac{1}{8}$ in. of, but not touching, the test surface. Make final adjustments of temperatures after a few minutes of operation.

Test cylinders are inspected by stopping the flow of circulating water with a clamp and lifting the glass cell from the water bath. It is not necessary to remove the specimen from the cell for inspection. Inspections should be made after 1 and 8 hr from the start and once each morning thereafter.

Failure is indicated when 3 points of corrosion are visible.

Evaluation of Tests for Forgeability

By ALAN B. DRAPER

Many laboratory forgeability tests are used, but there is little correlation among them and at present no standard forgeability test that can be easily performed and evaluated under shop conditions

WHILE many metals and alloys can be readily transformed from a billet or bar section into an intricate shape by forging with either open or closed dies, other alloys present great difficulties even in such simple operations as upsetting. In addition, the performance of a material during forging may vary greatly, depending upon differences in chemical composition, grain size, and surface condition.

Many attempts have been made to compare the forgeability of certain types of alloys. However, the wide variety of forged shapes, and the fundamental differences between the alternative procedures by which a particular part can be forged make it very difficult to define or measure "forgeability." The present survey of literature and of established commercial practices indicates a pronounced lack of agreement in this respect.

Various forging shapes and practices place different weight on certain properties of the material. Thus for comparatively simple forgings of common materials, a low resistance of the metal to plastic flow, or a low "flow stress," is probably its most important forging characteristic. In other instances the ability to withstand, without breakage, large changes in shape, or a high "ductility," are decisive for the success of the operation.

Other general requirements, which become more dominant as forging is progressively applied to the production of more and more complex shapes, are such properties as the ability to flow readily into narrow cavities and the possibility of forming extended thin flat areas. The mathematical and experimental analysis of such operations reveals that two components, the flow stress and the friction between the metal and tools, limit such operations as coining a sharp design or forging a part with a thin web. Until very recently, little attention has been paid to the importance of friction in hot forging.

Thus forgeability resolves itself into measuring three quantities: the *flow stress* or internal friction, the *ductility*, and the *friction coefficient* or external friction. Of these, flow stress and ductility are basic properties of the metal. The friction coefficient is a complex physical constant depending on the mechanical and chemical properties of the surfaces of the work and the tool in contact, as well as a lubricant applied to reduce friction and protect the die surfaces. In hot forging, temperature and speed are two important variables. In fact, the range of temperatures and speeds which can be used for a given alloy might be considered a fourth component of the term forgeability.

Survey and Evaluation

Nearly all conventional mechanical test procedures have been used, by one or more investigators, to determine certain of the metal characteristics which comprise forgeability, Siebel (**1**), Portevin, *et al* (**2**).[1] These are the compression, tension, bend, twist, and impact tests. In addition, a few specific forging tests have been proposed.

Compression Tests

A compression test to determine forging characteristics usually consists of upsetting a certain length of cylindrical or square material between flat dies (Fig. 1). This test, when fully evaluated, may provide all three forgeability components. Its more common use is determining either the flow stress or the ductility, although there have been some attempts to obtain friction data by means of compression tests.

Determination of Flow Stress by Compression

The conventional compression test performed in the laboratory at room temperature is commonly used to determine the stress-strain characteristics, or the change of flow stress with reduction, of materials in general (Fig. 1(*b*)). Hot-compression tests have also been used extensively for arriving at typical flow-stress values for many materials at various speeds (Fig. 2). Such investigations also include instrumentation of hammers, Ellis (**3**); Pomp and Houben (**4**); mechanical presses and fast-running hydraulic presses, Pomp, *et al* (**5**); Dietrich and Ansel (**6**). In addition, a special cam-operated compression-testing machine has been constructed for compressing a 1-in. high specimen to one half of its height, at constant rates ranging from 100 to 4000 per cent per sec, Orowan (**7**); Larke and Parker (**8**); Cook (**9**).

Flow stress data for various hot-forging temperatures and speeds have been determined for the following materials: carbon and alloy steels,

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[1] The boldface numbers in parentheses refer to the list of references appended to this paper.

Riedel (**10**); Hennecke (**11**); Pomp and Siebel (**1**); Portevin, *et al* (**2**); Cook and Woodcock (**12**); Cook (**13**); Cook and Blythe (**14**); copper and copper alloys, Doerinckel and Trockels (**15**); Hanser (**16**); Simmons (**17**); aluminum alloys, von Zeerleder, *et al* (**18**); Portevin, *et al* (**19**); Aluminum Company of America (**20**); and magnesium alloys, Portevin, *et al* (**19**); Beck (**21**); Dietrich and Ansel (**6**). In such work the flow stress is generally obtained for a typical reduction usually between 30 and 50 per cent.

In several of these studies the dependence of the flow stress on the reduction has also been determined. It has been generally observed (Fig. 2) that at high temperatures and speeds the flow stress varies with progressive upsetting, usually first to higher values and then to slightly reduced values. This is attributed primarily to two factors, one being the heat developed during forging, the other a limited strain hardening followed by recovery (softening) as the upsetting progresses. This uncertainty regarding the actual values of flow stress, however, is not of practical significance.

In forging hammer practice, the term forgeability has been frequently defined as the reduction resulting from a blow of given energy (Fig. 1), Ellis (**3**); von Zeerleder, *et al* (**18**); Pomp and Houben (**4**); Pomp, *et al* (**5**); Ginzburg and Ulman (**22**); Rauhaus (**23**); Cook and Davis (**24**); Cook and Woodcock (**12**). Such test data reflect a rate of reduction that is first very high and then gradually decreases to zero. No attempt, up to the present time, has been made to develop a universal relationship between the reduction obtained on hammering and the flow stress derived from constant-rate compression tests. However, some tests on steel showed that the energy consumed in impact compression (hammer velocity about 400 ft per min) was close to 1.8 times that consumed in compression with a hydraulic press (velocity about 3 ft per min) other conditions being identical, Pomp, *et al.* (**5**).

Tests performed in the laboratory with heated dies, or inside a furnace, usually yield the flow stress for a low rate of straining. At higher rates of straining, the flow stress is considerably increased, and this strain-rate effect may be very different for different metals. This even applies to such similar materials as carbon steels with different carbon contents, Cook and Woodcock (**13**) and alloy steels of different compositions, Siebel (**1**). Therefore, forgeability tests must be performed at rates comparable to those used in production.

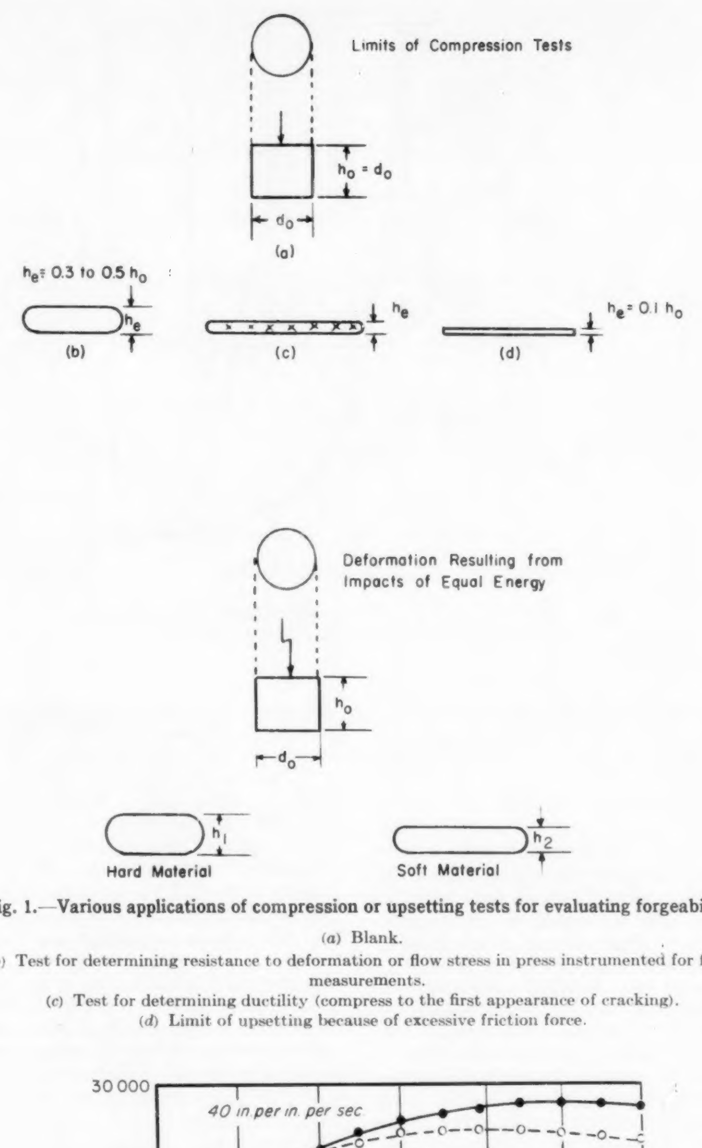

Fig. 1.—Various applications of compression or upsetting tests for evaluating forgeability

(*a*) Blank.

(*b*) Test for determining resistance to deformation or flow stress in press instrumented for force measurements.

(*c*) Test for determining ductility (compress to the first appearance of cracking).

(*d*) Limit of upsetting because of excessive friction force.

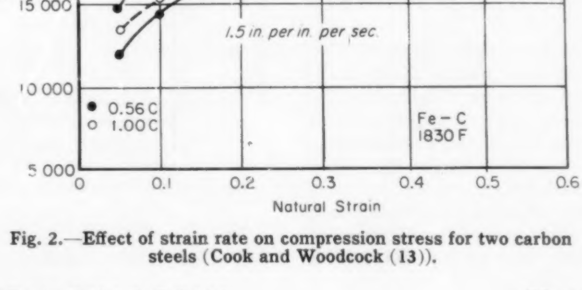

Fig. 2.—Effect of strain rate on compression stress for two carbon steels (Cook and Woodcock (13)).

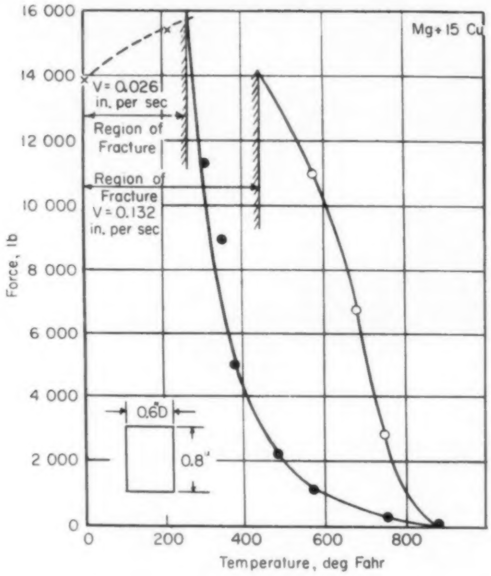

Fig. 3.—Effect of strain rate on compression force for a magnesium alloy-50 per cent reduction, Portevin, *et al* (2).

Evaluation of Ductility by Compression

A number of investigators used the compression test for evaluating the ductility of forging stock (Fig. 1(*c*)). It is generally observed that many alloys will develop cracks along the periphery of a compressed, barrel-shaped forging if the reduction exceeds certain values. This applies both to cold and to hot upsetting. It has been proposed that the reduction value at which such defects develop be used to measure the ductility component of forgeability. Thus, it has been suggested for nickel alloys that compressing a 1-in. cube to $\frac{1}{8}$-in. thickness, a reduction of 87 per cent, represents the practical limit for this forgeability test, Martin and Bieber (**25**). The ductility of a given alloy, at a particular temperature, is then obtained by subjecting a series of specimens to blows of different energy, and noting the reduction at which cracking first occurs. In the case of such nickel alloys this procedure has been found valuable for distinguishing between ductile and brittle (hot short) material at a given temperature.

In the case of magnesium alloys also, compression tests clearly revealed the importance of forming speed, Portevin and Bastien (**19**). Cracks developed at a high strain rate up to a considerably higher forging temperature than at a low strain rate (Fig. 3).

Attempts have been made to apply the compression test to copper-zinc alloys which offer rolling and forging difficulties in a certain range of composition, temperature, and speed, Doerinckel and Trockels (**15**). However, further investigations on copper alloys, Bunting (**26**); Hanser (**16**); Simmons (**17**) failed to disclose any relation between this test and the hot shortness of such materials. Thus it appears to be useful only where excessive hot shortness occurs or where surface defects or contamination may lead to cracking after extensive upsetting.

Regarding this application of a compression test it must be realized that the ductility of most materials is very high under conditions where the strains are strictly compressive. This applies particularly to extrusion. For example, many materials generally considered unforgeable can be forged successfully by methods which utilize extrusion, Schroeder (**27**). In contrast, as a cylindrical part becomes barrel-shaped on upsetting, associated tensile stresses occur around the periphery, Sachs (**28**). It is these secondary tensile stresses which limit the amount of compression and cause cracks to develop at the barrel surface. As the extent of barreling is known to vary with the magnitude of the friction forces at the interfaces between the dies and specimen, it may be expected that the ductility derived from a compression test also varies, depending upon the type of lubrication. This may explain the rather conflicting opinions and evidence in this respect.

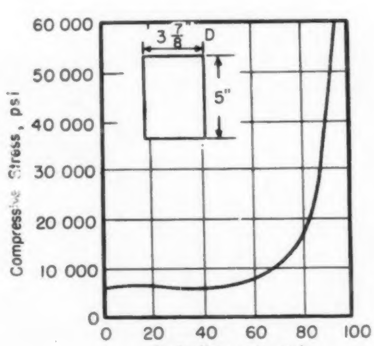

Fig. 4.—Compression-reduction diagram for a magnesium alloy up to high reductions, Dietrich and Ansel (6).

The Effect of Friction and Its Determination

It is well recognized that the unit pressure required for upsetting greatly increases as the reduction progresses to high values (Fig. 4), Dietrich and Ansel (**6**). This is the result of the increasing frictional forces at the die and metal interfaces, as the contact area between the dies and specimen expands during compression. As the friction forces restrain the lateral movement of the compressed piece, the unit pressure must increase to overcome this restraint, and it becomes practically impossible to carry the reduction beyond a certain limit (Fig. 1(*d*)).

This phenomenon has been investigated for the hot upsetting of steels, Ginzburg and Ulman (**22**); aluminum alloys and magnesium alloys, Schroeder and Webster (**29**); Schroeder (**27**); as well as for the compression of various alloys at room temperature, Sachs (**30**); Cook and Larke (**31**); Schroeder and Webster (**29**). Such studies reveal that the unit pressure is increased by an amount that depends on the ratio of diameter to height (thickness), on the one hand, and on the surface conditions at the interface on the other hand. Various theories exist for calculating the unit pressure and the total upsetting force on the basis of certain simple assumptions. Recently attempts have been made to apply such theoretical concepts to the determination of the frictional conditions, Schroeder and Webster (**29**); Schroeder (**27**); Alexander (**32**). However, the results of such attempts to evaluate the role of friction during forging are not completely established and, therefore, are subject to considerable uncertainty. On the other hand, if a simple relation between compression force and friction could be developed this would be very useful for the generally difficult problem

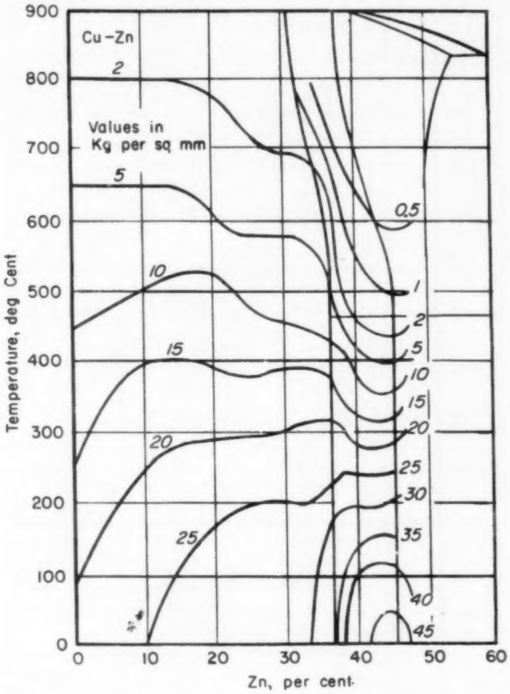

Fig. 5.—Tensile strength of brasses at different testing temperatures, Hanser (16).

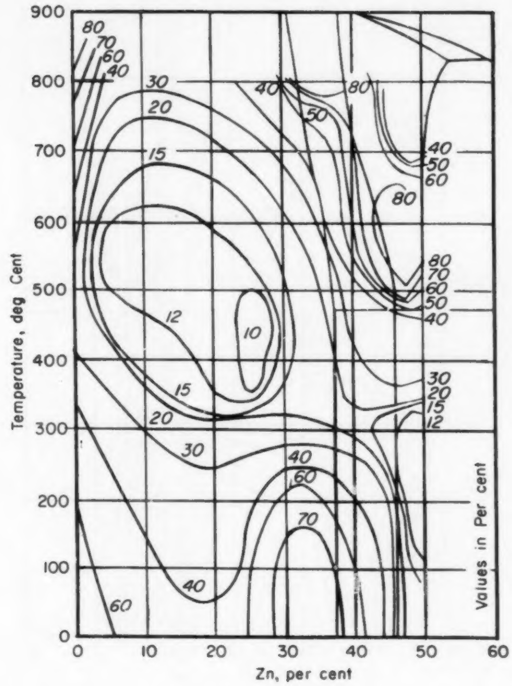

Fig. 6.—Reduction of area of brasses at different temperatures, Hanser (16).

of the evaluation of lubricants, as well as the evaluation of the limiting geometrical conditions, that is, the maximum-diameter-to-thickness ratio obtainable on upset forging.

Tension Tests

A tension test made at elevated temperatures to procure design data is executed at low rates of straining, or even as a creep test under constant load. However, tension tests have been used in several instances to evaluate the forgeability of copper alloys, Hanser (**16**) and aluminum alloys, Aluminum Company of America (**20**).

Static tests (0.1 ft per min) on copper-zinc alloys (Fig. 5) showed that the tensile strength may be of limited value as a measure of flow stress and that it may be distorted by low ductility. In contrast, only the reduction in area (Fig. 6), derived from such static tensile test data, could correctly outline the hot-shortness range of copper-zinc alloys.

An impact-tension test has been used to evaluate the forgeability of aluminum alloys. The specimen used was 1-in. gage length, 0.500-in. diameter, and was broken by a 220 ft-lb hammer, Aluminum Company of America (**20**). The energy consumed, divided by the elongation, is considered a criterion of the hammer forgeability of several aluminum alloys. This is obviously a measure of flow stress. The test may be used also to determine the maximum forging temperature, which is indicated by an abrupt decrease in energy and elongation with a small increase in temperature.

Bend Tests

Bending a rectangular test bar 180 deg under a steam hammer has been suggested as a test for evaluating the ductility of forging stock, Martin and Bieber (**25**). The temperature range suitable for forging is then limited by the cracking of the specimens at either lower or higher temperatures. Comparison with compression tests indicated that this "go-no-go" bend test corresponds to compressing to about 40 per cent reduction. It was found, therefore, to be too mild a test to reveal important conditions of embrittlement such as are found in forging practice.

Notch-Bend Tests

Bend tests on notched specimens have been repeatedly used for evaluating the ductility of alloys in forging practice. The preferred tests of this type are the common "impact tests" (notch-bar impact-bending tests).

The value of impact energy absorbed by the metal when broken in the impact hammer (a so called "impact strength") has been found to outline to a limited extent the range of hot shortness that occurs during rolling or forging copper-zinc alloys, Bunting (**26**) (Fig. 7). However, a low impact strength of these alloys is not necessarily an indication of low ductility, Hanser (**16**). Impact strength is a compound quantity, depending upon both the flow stress and the ductility of the material. Some alloys become very soft at high temperatures and their impact strength is correspondingly low, despite the fact that the specimen does not break but is severely bent and driven through the supports of the machine. This may obscure any embrittlement of the material when approaching its melting point. Such deficiency of the impact test may be eliminated by using the bend angle on fracture as the measure of ductility, Portevin and Bastien (**19**).

The impact test has also been used for evaluating the forging ductility of steels and brasses, Portevin, *et al* (**2**) aluminum alloys and magnesium alloys, Portevin and Bastien (**19**) as a function of temperature. It was found to be superior to either the impact-tension test or hammer upsetting test in revealing inferior ductility at temperatures either below or above the suitable forging range.

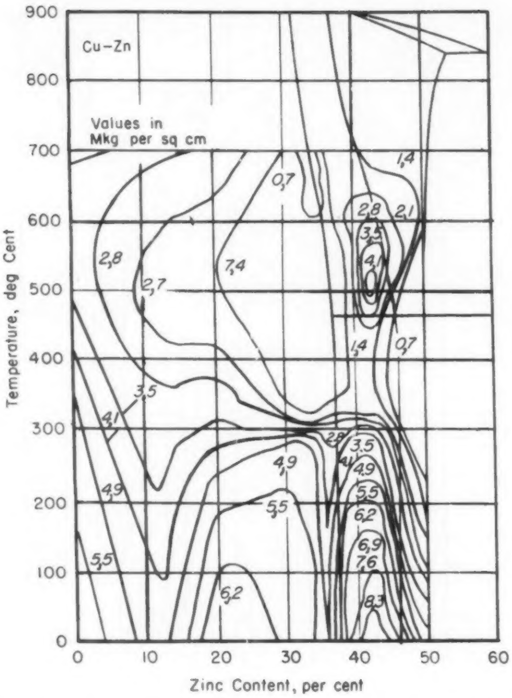

Fig. 7.—Impact strength of brasses at different temperatures. Data by Bunting (26); see Hanser (16).

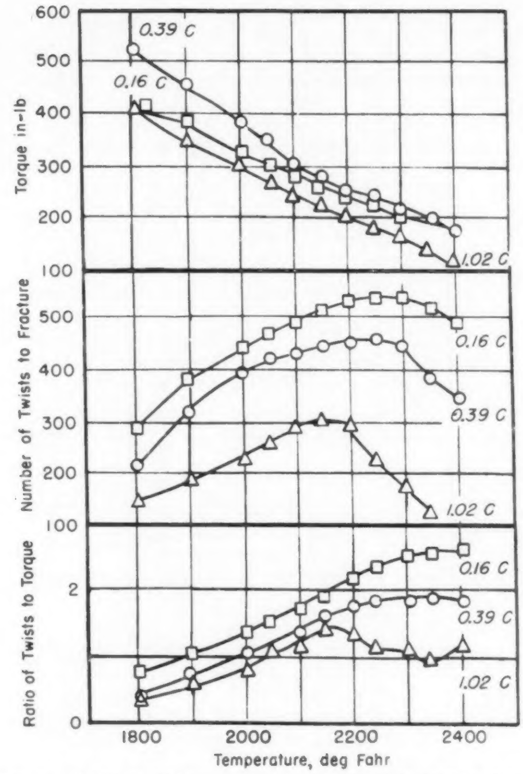

Fig. 8.—Effect of carbon content on hot-twist characteristics of carbon steel, Clark and Russ (34).

In these aforementioned investigations, static notch-bar bend tests were also made. The angle on fracture was again used as a measure of ductility. The results outlined ranges of maximum ductility which, however, were generally found to be more extended than those derived from impact tests. This is in agreement with the other previously mentioned evidence, which indicates that the rate of testing must simulate the velocity of forging.

Torsion Tests

Torsion tests at elevated temperatures, or "hot-twist tests," are considered by several investigators as the most suitable test method for evaluating the forgeability of alloy steels, Sauveur (**33**); Clark and Russ (**34**); Ihrig (**35**). Bars, having a diameter of $\frac{9}{16}$ to $\frac{5}{8}$ in. and having a length extending through a furnace, for example, 24 in., were twisted at 125 to 180 rpm. The time to failure was up to several minutes. Both the torque and the number of twists, at a series of temperatures extending beyond the normal forging range in both directions, were measured.

The torque is a relative measure of the flow stress and will assist in evaluating the force required to forge a given alloy at a specific temperature when compared with the torque obtained for an alloy for which the forging force is known, Clark and Russ (**34**) (Fig. 8).

The number of twists or turns is also a relative measure of ductility. It becomes a maximum within the temperature range suitable for forging. It also indicates particularly the forging temperature which cannot be exceeded without deterioriation or "overheating" of the metal, Clark and Russ (**34**); Ihrig (**35**). A certain number of twists, for example 50, must be exceeded to permit rotary piercing, while somewhat less ductile materials can still be forged into billets or rolled. No application of the hot-twist test to die forging has been attempted to date. It should be noted that, while the effect of speed was found to be comparatively small for steels, it is much more important for non-ferrous alloys.

Special Forgeability Tests

In order to demonstrate the effect of friction, a special test has been proposed in which a conical punch is pushed into a cylindrical blank, von Zeerleder, *et al* (**18**). By means of such tests, it has been demonstrated that lubrication has a greater effect on the forgeability of aluminum alloys than on that of brass, or particularly iron (Fig. 9). Apparently, no further work has been performed utilizing a test of this type for the quantitative measurement of the effect of frictional conditions on forgeability.

It is, of course, general practice in some instances to forge a few pieces of a particular part in order to test whether a new alloy or a certain slug shape can be forged with a given practice into an acceptable forging of a specific design. However, this "go-no-go" test is time consuming and costly.

Possible Approaches to the Study of Forgeability

From the information available so far, the following approaches to a systematic development of forgeability tests may be suggested.

Compressing or upsetting a cylindrical blank has been studied most extensively. It can supply both the flow stress of the metal and the frictional resistance at the interface. The force required to compress the blank by 30 to 50 per cent comprises the simplest measure of flow stress. However, to obtain the upsetting force, a common or special press, instrumented for recording the forging force and the stroke, must be available. A complete force-stroke

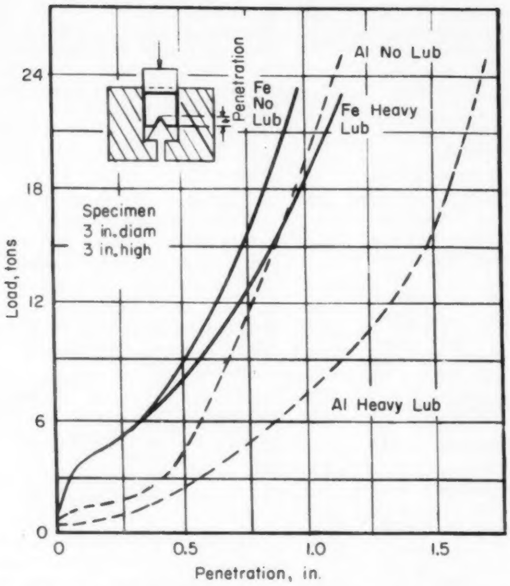

Fig. 9.—**Effect of lubrication on penetration in the compression test. Only vertical material movement was allowed, von Zeerleder *et al* (18).**

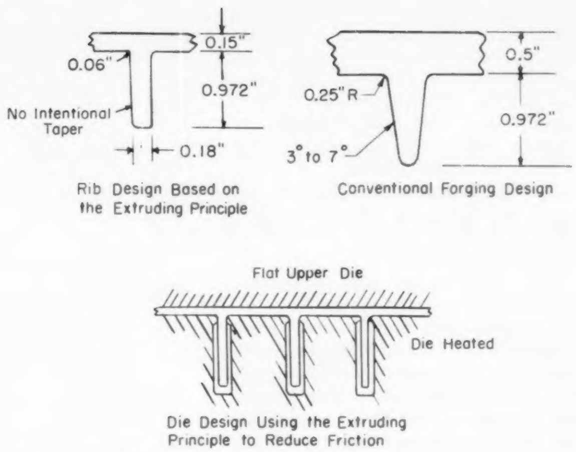

Fig. 10.—Comparison of conventional design and extruding design in forging dies, Schroeder (27).

curve, or a set of these for several speeds up to the capacity of the equipment, would comprise the most desirable and complete information. Such instrumentation has been developed both for hydraulic presses and for hammers, Cook (**9**); Ellis (**3**); Pomp and Houben (**4**).

The energy and reduction in hammer forging may be used to arrive at the flow stress. However, impact results in large losses and the true relation between energy and compressive force or stress is not yet definitely known, if any exists at all.

To determine the friction, two basic force values, one for a small reduction (20 to 50 per cent) and the other for a large reduction (80 to 90 per cent) are possibly sufficient. However, a set of force data for a number of reductions, or preferably a force-stroke curve, supplies more complete and accurate information from which it should be possible to derive the frictional conditions. To date, this problem has been studied only very incompletely. Schroeder and Webster (**29**); Schroeder (**27**).

Using a square or rectangular, rather than a cylindrical blank, probably affects the contribution of friction only to an insignificant extent; but this matter deserves further study. Both the flow stress and the friction forces can be derived from tests using rectangular bar stock and indenting it with flat straight punches of various lengths, Alexander (**32**). However, this method has been tested only in the case of cold forming, so it is not clear whether it is applicable to hot forging, and it should be investigated further.

A special test has been proposed for evaluating the frictional conditions. This test consists of indenting a cylindrical blank with a conical round-nosed punch, von Zeerleder, *et al* (**18**). However, so far this test has been used only to demonstrate, rather than to calculate, the effects of material and of forging speed.

Filling or extruding into a die cavity comprises an important function of many forging operations, Pomp, *et al.* (**5**). Apparently, no attempt has been made to evaluate the effect of friction under such conditions. It is clear, however, that friction can be kept at a minimum by making the cross-sectional area of the projection constant. Additional friction reductions can be obtained by making the contact length of the die opening as short as possible (Fig. 10). The forging of parts with "extruded" ribs or similar projections can be carried out to much greater length-to-thickness ratios by the utilization of the extrusion principle than by conventional die forging, Schroeder (**27**).

To date, ductility at forging temperatures has been evaluated only by upsetting and bending tests in either a press or hammer. While such tests were found to be useful for certain specific purposes, their general applicability to forgeability and, particularly to die forgeability, has been denied by many investigators. There appears to be a definite lack of a simple forgeability test which rates materials in much the same manner as tension or torsion tests. Possibly, some test patterned after the bulging or expansion tests used to evaluate the ductility of plate, sheet or tube (at room temperature), may offer a solution to this problem.

Summary

Several primary facts resolve themselves from the preceding discussion:

1. The forgeability tests now used have been primarily designed to test materials prior to forging the cast ingot into a billet, or prior to rolling billets, plate, and sheet. No standard forgeability test has been developed for closed die forging.
2. Many of the forgeability test methods proposed necessitate equipment other than forging presses and hammers.
3. Static tests, performed at slow speeds, frequently yield a different rating of the materials from those found in forging practice. They may either depreciate or enhance certain features of forgeability observed at higher rates of straining.

A practical forgeability test must supply values which clearly delineate or identify *each* of the three distinctly different characteristics of a material to be forged in a closed die. These three components of forgeability as defined in the present paper are: (1) the flow stress or internal friction, (2) the ductility, (3) the friction coefficient or external frictional resistance.

The two major variables which affect these three characteristics are the forging temperature and, particularly for certain types of materials, the forging speed. In addition, ductility depends greatly upon the type of forging and possibly also upon the same factors which determine friction. The frictional resistance depends particularly upon the lubricant. It may also be affected by the roughness of the die and blank contact surfaces.

The compression test when fully evaluated by a set of force stroke curves, can supply all three components of forgeability. Several other tests have been used to evaluate the friction and flow stress in cold forming operations, but these have not been evaluated for hot forming. In addition, the use of a conical mandrel indentation test and extrusion into a cavity have been proposed, but not evaluated. Some success in evaluating ductility by a bulging or expansion test has been achieved, but the work has not been completed.

Acknowledgment:

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Temperatures of Bituminous Roof-Surfaces*

By E. R. BALLANTYNE and J. W. SPENCER

Painting black bituminous flat roofs with a white reflective coating reduced surface temperature 15 F for more than 10 per cent of the time

TEMPERATURE and rate of change of temperature are both likely to be important factors affecting the durability of bituminous roof membranes. Temperature will be important because oxidation of bitumen is one of the agencies which causes deterioration, and like most other chemical reactions this will take place at a higher rate at higher temperatures. (Deterioration is also accelerated by the presence of light.) Rate of change of temperature may be important because the stresses produced during thermal expansion and contraction of the bitumen and its reinforcement will be less at low rates of change of temperature, due to the viscoelastic nature of the bitumens normally used for roofing. Since bitumen has a large coefficient of cubical expansion, of the order of 3×10^{-4} per degree Fahrenheit, the variation of stresses at different rates of change of temperature may be large.

Very little information has been published on temperatures attained by bituminous roof surfaces. Beckett (**1**)[1] recorded maximum temperatures attained on the upper and lower surfaces of various thicknesses of concrete slabs covered with a layer of roofing felt. The Institut National de la Technique de l'Etanchéité (**2**) compared temperatures attained on bituminous roofings having surface treatments of aluminum foil, gravel, and bare bitumen, and laid on both dense and lightweight concrete. Roux (**3**) gave a method of calculating roof temperatures for a steady state condition, but such a state is seldom if ever obtained. Cottony and Dill (**4**) determined the daily mean rise in temperature of a variety of surfaces for a period of five days.

Since no information was available on how temperature varied throughout the year on various bituminous roof surfaces it was decided to measure such data at Highett, near Melbourne, Australia, by means of thermocouples connected to a 16-point high speed recorder. Highett is a residential suburb, 110 ft above sea level, $2\frac{1}{2}$ miles from Port Phillip Bay and 10 miles southeast of Melbourne (latitude 38 deg south, longitude 145 deg east). The terrain is fairly flat and the atmosphere is relatively free from smoke haze.

Experimental Procedure

Roof Construction

Records were kept of the surface temperatures of membranes on both pitched and flat roofs on a long narrow building running east and west and sited on open flat land. The width of the roof in plan was 19 ft 8 in., the length of the pitched roof section 45 ft, and of the flat roof section 136 ft. The pitched roof was framed with 4 by $1\frac{1}{2}$-in. hardwood with slopes facing north and south at approximately 27 deg to the horizontal, and the flat roof was supported by 6 by 2-in. hardwood rafters at a slope of 1 in 32 (approximately 1.8 deg) rising from the north to the south. The ceiling of the flat roof section was fixed directly to the rafters. In both cases the roofs were sheathed with $\frac{3}{4}$-in. tongue-and-groove Douglas fir running across the slope, and no insulation was provided. The only ventilation of the roof space was through loosely fitting battens below the eaves. The built-up membrane had three layers of coated bituminous roll roofing (approximately 50 lb per 108 sq ft) bonded together with hot bitumen.

Surface Treatments

The various surfaces were treated with bitumen, aluminum paint, or whitewash as given in Table I, and in no case was the area of any one treatment less than 30 sq ft. All surfaces were coated 56 days before the beginning of the yearly period reported here, and subsequent maintenance treatments were applied at the times set out in Table I. The frequent maintenance given to the whitewash surface was not sufficient to prevent deterioration, which had usually occurred before it was recoated.

Temperature Measurement

The temperatures of the various surfaces were measured with thermocouples consisting of 32 standard wire gage enameled copper wire and 33 standard wire gage "Ferry" (56 Cu, 44 Ni) wire. Both wires were covered with extruded poly(vinylchloride) about 0.03 to 0.04 in. thick. The junctions were welded electrically by sparking in air, and the thermocouples were calibrated in a water bath against a standard thermometer. The junctions were bedded on the roof surfaces by gently pressing with a hot soldering iron. Surfaces were redressed where they were disturbed by this treatment.

Temperatures were recorded on a 16-point recorder, the printing speed of which was reduced so that a complete cycle of 16 points was recorded in 153 sec instead of in 64 sec. This gave a less crowded chart record, the reading of which was further facilitated by using a chart reader designed and built at this Division.

E. R. BALLANTYNE and JOHN W. SPENCER have been with the Division of Building Research of the Commonwealth Scientific and Industrial Organization, Highett, Victoria, Australia, for eight years, studying various aspects of waterproofing of structures, particularly problems associated with flat roofing and calking materials.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the authors. Address all communications to ASTM Headquarters, 1916 Race St., Philadelphia 3, Pa.

* The work described in this paper was carried out as part of the program of the Division of Building Research, Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia.

[1] The boldface numbers in parentheses refer to the list of references appended to this paper.

TABLE I.—SURFACE TREATMENTS.

Surface Treatment		Surface Position	Resurfacing (days elapsed from first surfacing)
Brief Description	Detailed Description		
Black	Mopped with hot air blown bitumen having a penetration (100 g for 5 sec at 25 C) of approximately 40 units and a softening point (Ring and Ball) of approximately 195 F	North pitch South pitch Flat	
Aluminum paint No. 1	Bituminous-based commercially available aluminum paint	North pitch South pitch Flat Flat	187 187 187 187
Aluminum paint No. 2	Bituminous-based aluminum paint made to following formula: 2 lb air-blown bitumen, softening point 185 F, penetration 40; 2 lb leafing aluminum powder; mineral turpentine to 1 gal		
Aluminum paint No. 3	Varnish-based commercially available aluminum paint	North pitch South pitch Flat	187 187 187
White	Lime-tallow whitewash made to formula of Building Research Station, Great Britain (5). Quicklime 90 per cent, tallow 10 per cent		43, 97, 148, 187, 299, 324

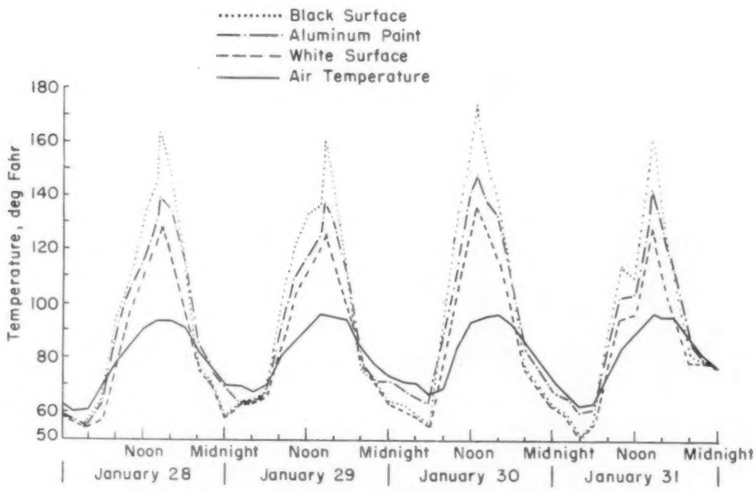

Fig. 1.—Temperatures of various flat roof surfaces in Melbourne, Jan., 1951.

Results and Discussion

Temperatures for each surface at every hour throughout the year December 1, 1950, to November 30, 1951, were obtained from the charts and minimum and maximum temperatures during this period were obtained by inspection of the hourly figures. A plot of the hourly figures for four consecutive hot days in January, 1951 is shown in Fig. 1, and the mean hourly figures for January and July, 1951 are given in Fig. 2.

Extraction of statistics from the mass of figures obtained was facilitated by transferring the data to Hollerith punched cards. This enabled both the frequency distribution of temperatures for each surface and the frequency distribution of temperature differences between the black surface of similar orientation and each of the other surfaces to be readily obtained for the whole year. Figure 3 is an example of the former, and shows the frequency distribution of temperatures for the flat black surface. In Fig. 4 the high-temperature end of this distribution is magnified and compared with similar data for surfaces treated with aluminum paint and whitewash, and with air temperature distribution. Figure 5 shows the frequency distribution of temperature differences between black flat surfaces and those treated with aluminum paint No. 1 and whitewash and between black surface and air. The frequency distribution of air temperatures for the year is shown in Fig. 6.

The minimum, maximum, and average surface temperatures for each of the surfaces are shown in Table II.

The maximum temperature for the white surface is shown as 151 F, but this was undoubtedly a higher temperature than a freshly applied white surface would have given. As stated previously the lime-tallow whitewash had a very short life and frequent maintenance was necessary. The high figure of 151 F was obtained when maintenance was required (95 days after first surfacing) and when the treatment had lost some of its reflective value. A more reliable indication is obtained by comparing the average temperatures of the various surface treatments. This shows that a larger reduction in temperature was achieved by using a white surface.

The temperatures shown in Table II are those obtained by considering hourly readings only, but higher maximum temperatures were actually recorded on the charts between the hourly values. Thus the flat black surface gave a maximum of 178 F and the north pitch black surface gave a maximum of 184 F.

In Table III are shown some data on the temperature reductions given by various reflective treatments when compared with the black bitumen surface. The maximum instantaneous temperature reduction is given, but the temperature reductions for various percentages of a year are more useful as a guide to the efficiency of the various treatments. The table shows that the white treatment is much more efficient than the aluminum paints and that the varnish-based aluminum paint is slightly more efficient than the bituminous based. (However, the former is more likely to crack on a bituminous surface.)

In some countries 140 F is taken as an approximate maximum roof temperature, and it is of interest to see the number of hours in a year for which this temperature was equaled or exceeded and to compare this with the total hours of sunshine for the same period. These data are presented in Table IV. For the year under consideration (December, 1950 to November, 1951), Melbourne had a total of 1958 hr of sunshine.

A highly significant linear relationship was found between the hours of sunshine for each month (S) and the number of hours that the flat black surface was 25 F or more above air temperature (N). This relationship is given by $N = -38.8 + 0.897S$. A plot of the relationship is given in Fig. 7. Allowance for the variation of the average meridian altitude of the sun for each month by substituting the total

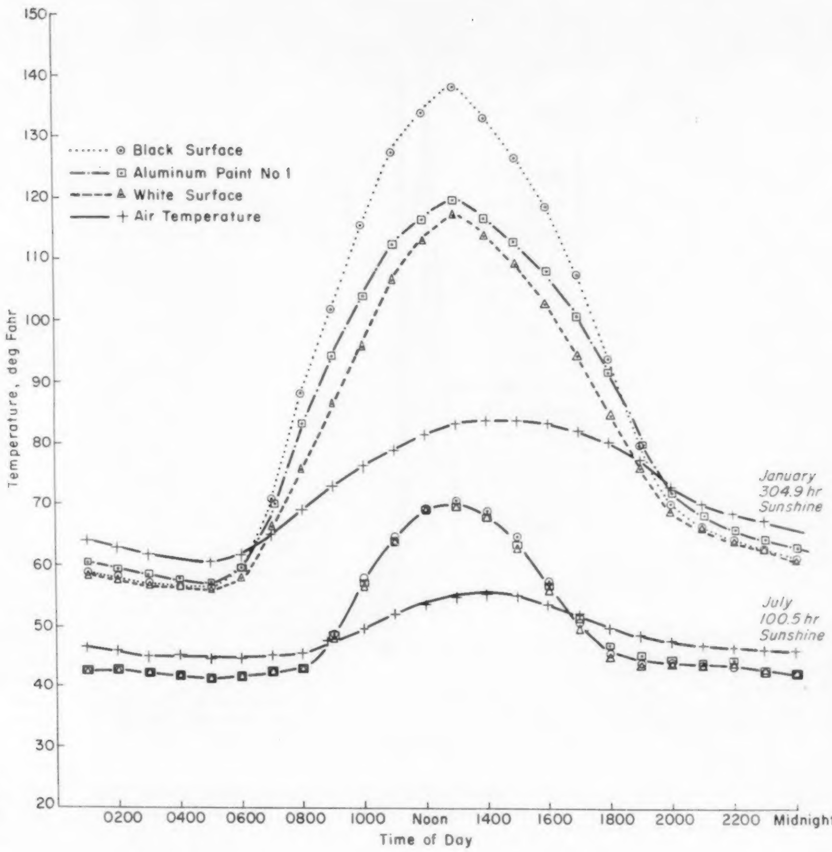

Fig. 2.—Mean hourly temperatures of flat roof surfaces for January and July, 1951.

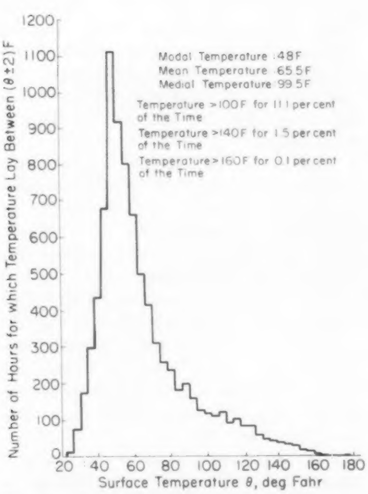

Fig. 3.—Frequency distribution of temperatures of flat black surface for one year (Dec. 1950 to Nov. 1951).

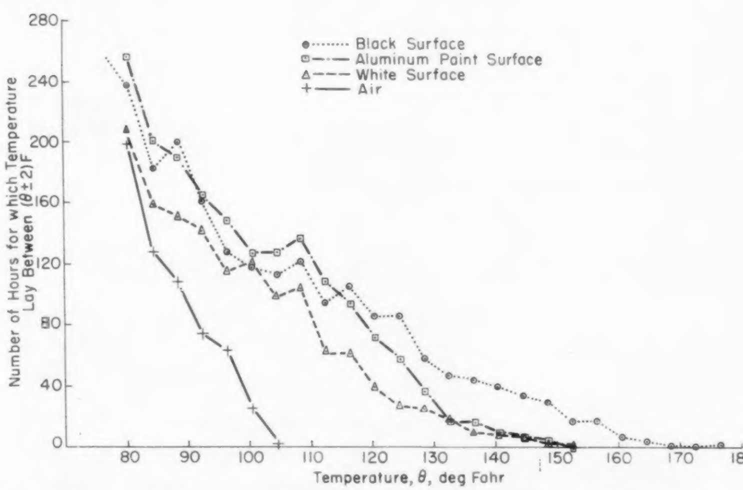

Fig. 4.—Portion of frequency distribution of temperatures on flat surfaces for one year (Dec. 1950 to Nov. 1951).

radiation reaching a horizontal surface per month for monthly hours of sunshine did not give a better fitting linear relationship than the above.

It is impractical to calculate mean rates of change of temperature over the whole year; in any event such figures would have little meaning. However, some idea of their magnitude was obtained by averaging the values taken at certain times on the first day of each month; these average values are shown in Table V. Inspection of all the records showed that the maximum rate of change of temperature of the flat black surface recorded during the year was a rise of 14.9 F per min (38 F in 153 sec) at 12:10 p m on November 29, 1951.

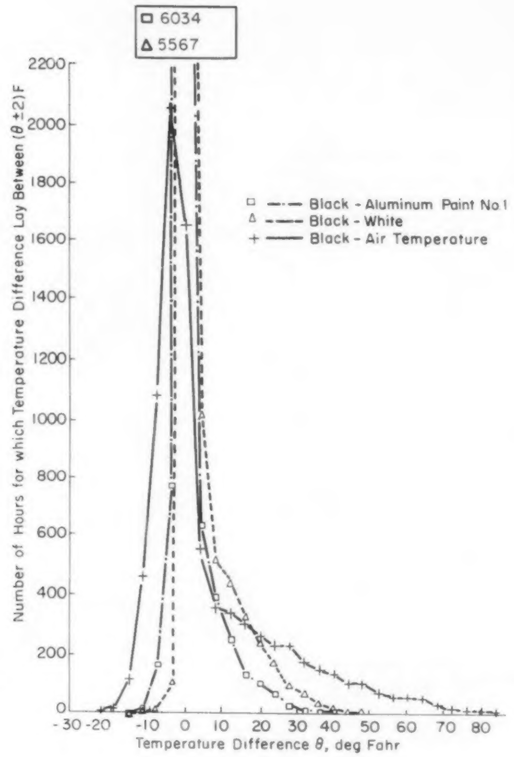

Fig. 5.—Frequency distribution of temperature differences between black surfaces and other flat surfaces for one year (Dec., 1950 to Nov., 1951).

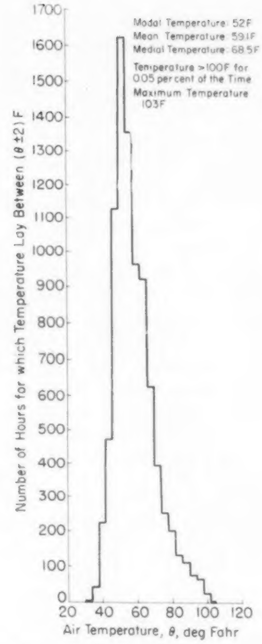

Fig. 6.—Frequency distribution of air temperatures (Stevenson screen) for one year (Dec., 1950 to Nov., 1951).

TABLE II.—MINIMUM, MAXIMUM, AND AVERAGE SURFACE TEMPERATURES, DEG FAHR.

Surface	Flat			North Pitch			South Pitch		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Black	24	175	65.5	24	178	68.5	24	165	65.1
Aluminum paint No. 1	24	150	64.1	24	151	65.4	24	138	62.1
Aluminum paint No. 2	24	146	64.2	..	...	...	..	...	...
Aluminum paint No. 3	24	145	63.8	24	145	64.3	24	143	62.0
White	23	151	61.4	..	...	...	..	...	...

Air Temperatures: Min 34 F; max 103 F; avg. 59.1 F.

TABLE III.—TEMPERATURE REDUCTIONS, COMPARED TO THE BLACK SURFACE, PRODUCED BY VARIOUS REFLECTIVE TREATMENTS.

Position	Surface Treatment	Instantaneous Temperature Reduction, max, deg Fahr	Temperature Reduction for 1 per cent of Year, deg Fahr	Temperature Reduction for 5 per cent of Year, deg Fahr	Temperature Reduction for 10 per cent of Year, deg Fahr
Flat	Aluminum paint No. 1	39	23 or greater	12 or greater	7 or greater
	Aluminum paint No. 2	34	22 or greater	12 or greater	6 or greater
	Aluminum paint No. 3	38	24 or greater	13 or greater	8 or greater
	White	49	31 or greater	21 or greater	15 or greater
North pitch	Aluminum paint No. 1	37	27 or greater	18 or greater	13 or greater
	Aluminum paint No. 3	42	33 or greater	23 or greater	17 or greater
South pitch	Aluminum paint No. 1	37	27 or greater	18 or greater	12 or greater
	Aluminum paint No. 3	35	25 or greater	18 or greater	12 or greater
Air shade temperature		84[a]	64 or greater[a]	44 or greater[a]	32 or greater[a]

[a] Difference in temperature between flat black surface and air.

Change in air temperature over the same period was less than 1 F. Changes of temperature in excess of 10 F per min were recorded for this surface on several occasions during December, 1950, but they did not coincide with sudden changes in air temperature. Melbourne is noted for sudden cool changes (**6**) but it was observed that surface temperatures did not change rapidly at these times.

Aluminum foil surface temperature measurements made at the same time are not reported here since they were considered unreliable due to the thermocouple junction not always being in contact with the aluminum foil.

This difficulty has recently been overcome by using an improved technique by which the thermocouple was welded to a small piece of aluminum foil and the combination was cemented to the aluminum foil roof surface with a thin film of "Pliobond," the thermocouple being on the lower side of the combination. Thus the welded junction was not exposed directly to the weather, but the temperatures recorded were essentially those of the surface, on account of the high thermal conductivity and small thickness of the aluminum. The results obtained on a typical warm day are shown in Fig. 8, from which it can be seen that aluminum foil is superior to aluminum paint

TABLE IV—TIME FOR WHICH TEMPERATURE WAS NOT LESS THAN 140 F., AND COMPARISON WITH TIME FOR WHICH SUN WAS SHINING.

Position	Surface Treatment	Time for which Temperature $\geq$140 F, hr	Proportion of Total Hours of Sunshine for which Temperature $\geq$140 F, per cent
Flat..........	Black	143	7.3
	Aluminum paint No. 1	21	1.1
	Aluminum paint No. 2	9	0.5
	Aluminum paint No. 3	8	0.4
	White	18	0.9
North pitch..	Black	269	13.8
	Aluminum paint No. 1	24	1.2
	Aluminum paint No. 3	7	0.4
South pitch..	Black	124	6.3
	Aluminum paint No. 1	0	0
	Aluminum paint No. 3	2	0.1

TABLE V.—AVERAGE RATES OF TEMPERATURE CHANGE ON FLAT ROOF.

Time of Day, hr	Black Surface, deg Fahr per min	White Surface, deg Fahr per min
8 am.......	0.25	0.08
10 am.......	1.08	0.28
12 noon.....	1.18	0.34
2 pm.......	1.08	0.08
4 pm.......	0.59	0.18
6 pm.......	0.13	0.06

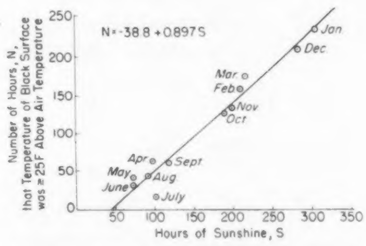

Fig. 7.—Correlation between hours of sunshine and number of hours that black surface temperature was $\geq$25 F above air temperature.

but inferior to white paint in its ability to lower the temperature of surfaces exposed to radiation from the sun.

It is of interest to note that the surfaces other than the aluminum foil were often considerably below air temperature during the night, due to radiation to the night sky. The lower emissivity of aluminum at low temperatures often results in the night temperatures of this surface being considerably greater than for other surfaces. On the day for which the results shown in Fig. 8 were obtained, the early morning hours before 7 a m were overcast but the sky was relatively clear of cloud during the evening hours after 7 p m. When the sky was overcast there was not very much radiation from the various surfaces and hence little difference in the temperatures. When the sky was relatively clear there was considerable radiation to the night sky from the painted surfaces, but little from the aluminum foil, so that the surface temperatures of the former fell by more than 5 F below air temperature.

It has been shown that a freshly prepared white surface is appreciably more efficient than an aluminum paint surface, but the lime-tallow white surface used in these experiments had such a poor durability that some of the results given in Tables II and IV tend to show the reverse. As a practical compromise bituminous based aluminum paints have generally been recommended. However, white paints of greater film strength may give satisfactory performance on saturated asbestos felts since there is no bitumen coating to allow shrinkage of the paint film and subsequent cracking, the tendency to shrink being restrained by the felt. A white alkyd resin emulsion paint on saturated asbestos felt has given good performance except at laps and edges, where there is a tendency for the strong paint film to curl the felt back. Thus a bituminous based aluminum paint treatment for 1 to 2 in. from all edges, together with a white paint on the rest of the surface, may be the best compromise between durability and reflective efficiency for saturated asbestos felts.

Conclusions

Temperature measurements made over a period of one year on flat roof surfaces at Highett, Victoria, showed that reductions of 15 F or greater for 10 per cent of the time can be achieved by treating a black bituminous surface with a suitable white reflective coating. In this period the maximum reduction measured was 49 F for the same coating. Temperature reductions obtained with aluminum paints were not as large. It was shown that for a given reflective surface finish, the temperature reductions observed for 10 per cent of the time in one year can be even greater on pitched roofs than on flat roofs.

Acknowledgment:

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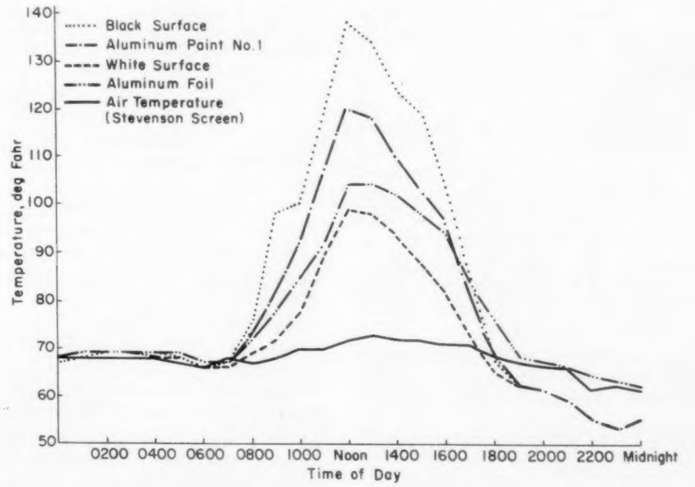

Fig. 8.—Temperatures of various flat roof surfaces in Melbourne, March 27, 1956.

Nondestructive Determination and Control of Shallow Carburized Case Depths

By ROMEO SUFFREDINI

The correlation of liquid-carburized case depths of rifle and shotgun parts with their Rockwell Superficial Hardness values was investigated in the hope of finding a nondestructive test that would cut costs, save time, and give greater standards of protection than methods of fracture testing and microscopic examinations.

THE Rockwell superficial hardness tester rather than the regular Rockwell tester was selected for the experiments reported in this paper because of its more sensitive depth measuring system. It employs a minor load of 3 kg and a major load of 15, 30, or 45 kg. As with the regular Rockwell tester, hardness is measured by determining the depth of penetration of an indenter into a specimen under fixed conditions. This fact enables a determination to be made of the case depths of liquid carburized parts. However, it must be remembered that the hardness reading or related indenter impression depth is not the true hardness (or true depth) of the case alone, but is a resultant of the combined hardnesses of the case and core.

For this study AISI steels C1010, B1112, and C1120 were liquid-carburized under constant conditions to various case depths, then quenched in either oil or water, and tempered at various temperatures. Carburizing samples of these steels in the form of either hot-rolled bars or cold-rolled strip were machined to the dimensions shown in Fig. 1.

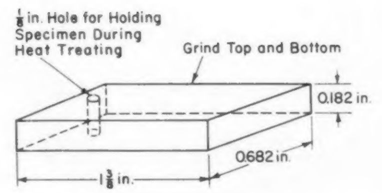

Fig. 1.—Carburizing test specimen.

Three hundred of the prepared specimens were divided into groups of thirty for carburizing. These groups, which consisted of ten specimens of each steel, were liquid-carburized in a molten cyanide type salt bath for various carburizing cycles ranging from 5 to 60 min. On completing the predetermined carburizing cycles, half of each group was quenched in oil and the other half in water; each half consisted of five specimens of each steel.

To keep the carburizing conditions as constant as possible, an automatically controlled 450-lb salt bath with 20.5 per cent cyanide content was held at 1550 F throughout the carburizing portion of the experiment.

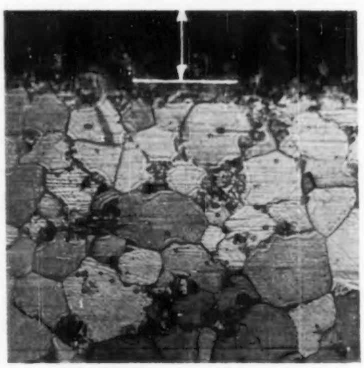

Fig. 2.—A typical case. The white arrow and base line indicate C1010 liquid carburized steel with a case depth of 0.0027 in. (× 200; Nital etch.)

After quenching, and tempering the carburized specimens at 350 F for 20 min in niter, hardness determinations were made on all 300 specimens with the Rockwell superficial hardness tester, using the 15 N, 30 N, and 45 N hardness scales. At least ten hardness determinations were made with each hardness scale on each specimen. On completion of this series of determinations hardness surveys were repeated on the same specimens after tempering at 600 F, and again after tempering at 750 and 850 F.

TABLE I.—CHEMICAL ANALYSIS OF LIQUID CARBURIZING SPECIMENS.

AISI Specification	Composition, per cent			
	Carbon	Manganese	Phosphorus	Sulfur
C1010...	0.09	0.40	0.02	0.04
B1112...	0.10	0.78	0.11	0.16
C1120...	0.18	0.97	0.03	0.13

On completion of the hardness surveys, five or more determinations of the total effective case depth were taken of each specimen. Case depths were determined by microscopic measurement of the distance between the outer edge of the carbon-nitrogen enriched areas and the first indications of free ferrite. Most of the microscopic measurements were made at a magnification of 100, but on shallow and difficult-to-determine case depths, magnifications of 200 to 500 were used. A typical case is shown in Fig. 2.

As an additional check on the case depth measurements, Knoop microhardness surveys were taken across the carburized case of randomly chosen specimens with known microscopically

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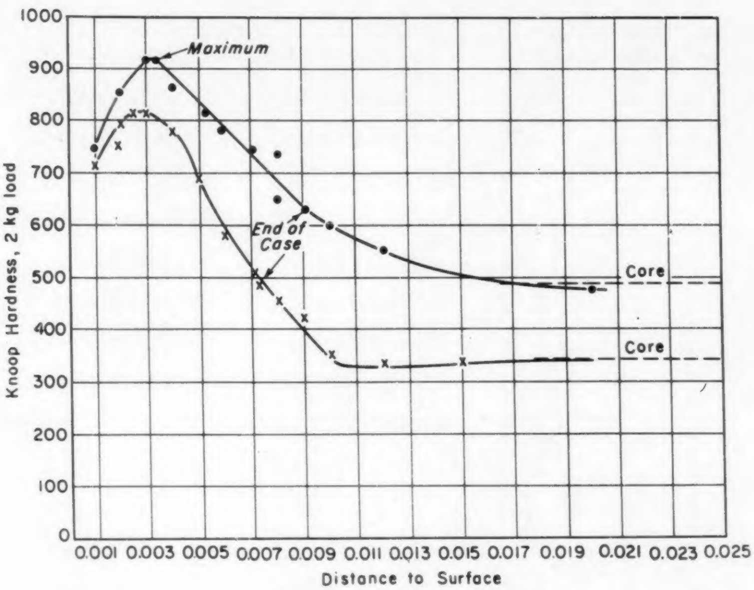

Fig. 3.—Typical graphic Knoop hardness gradients of liquid carburized specimens.

The dotted curve represents C1120 steel water quenched and tempered at 350 F. The case depth was 0.0088 in. Rockwell superficial hardness readings were: 15 N, 92; 30 N, 81; and 45 N, 67. Knoop hardness numbers were: surface, 793; maximum, 905; end, 610; and core, 487.

The other curve represents C1120 steel oil quenched and tempered at 350 F. The case depth was 0.0075 in. Rockwell superficial hardness readings were: 15 N, 89; 30 N, 64; and 45 N, 40. Knoop hardness numbers were: surface, 740; maximum, 806; end, 502; and core 340.

determined case depths. The Knoop hardness surveys consisted of microhardness gradients of the carburized cross-section of the various specimens from the surface to the core. The Knoop hardness gradient of carburized cases revealed that hardness at the termination of the microscopically determined case, which may be better called the case demarcation line, was a result of both the hardenability of the material and the heat treatment it received. A summary and a typical graphic plot of the Knoop hardness surveys are shown in Table II and Fig. 3.

Typical graphic plots of average Rockwell superficial hardness values and total effective case depths are shown in Figs. 4 and 5, for AISI 1010 quenched in oil and tempered at various temperatures. The curves of each graph were plotted averages of 50 or more hardness values and 25 or more case depth determinations at each set of conditions. Figure 6 shows a plot of liquid-carburized case depths versus time in the carburizing bath. This experimental data can be seen in tabular form in Tables V to VIII.

A tabular summary of liquid carburized case depths in terms of resulting Rockwell superficial hardness values can be found in Table III. This tabu-

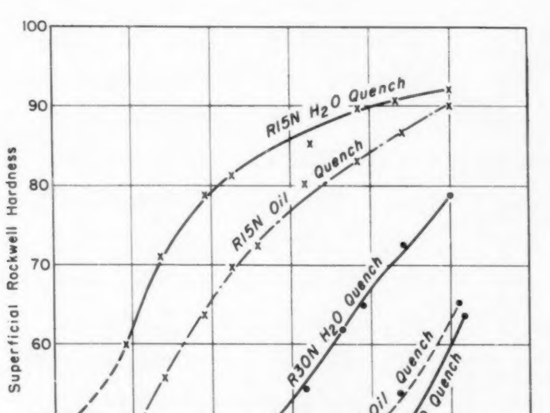

Fig. 4.—Case depth versus superficial Rockwell hardness.

Specimens of C1010 steel were carburized at 1550 F in a 20.5 per cent sodium cyanide salt bath, then tempered at 350 F for 20 min. Chemical composition and specimen size were those given in Table I and Fig. 1. Core hardnesses of oil-quenched specimens were: 15 N, 46; 30 N, <20; those of water-quenched specimens were: 15 N, 49; 30 N, <20. Hardness values represent the average of 50 determinations; case depths are the average of 25 determinations.

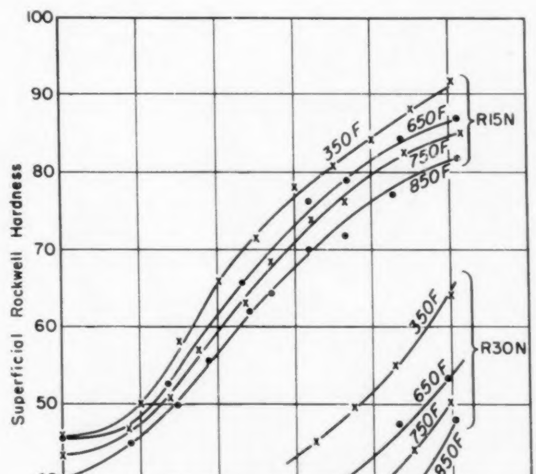

Fig. 5.—Effects of tempering at various temperatures on superficial Rockwell hardness of various case depths of oil-quenched C1010 steel.

Specimens of C1010 steel were directly quenched from the carburizing bath and tempered at various temperatures for 20 min. The hardness values given are the average of 50 determinations; case depths are the average of 25 determinations.

TABLE II.—AVERAGE KNOOP HARDNESS (2 kg LOAD) GRADIENT OF LIQUID CARBURIZED STEEL SPECIMENS.

Type of Steel	Type of Quench[a, b, c]	Surface	Maximum	At End of Microscopically Determined Case Depth	Core
C1010....	Water	866 (Rc65)	940 (Rc67)	477 (Rc45)	231 (R_B95)
C1010....	Oil	731 (Rc61)	734 (Rc61)	232 (R_B95)	135 (R_B64)
B1112....	Water	796 (Rc64)	921 (Rc66)	527 (Rc50)	290 (Rc24)
B1112....	Oil	752 (Rc62)	740 (Rc61)	259 (R_B98)	209 (R_B90)
C1120....	Water	791 (Rc64)	910 (Rc66)	588 (Rc53)	487 (Rc46)
C1120....	Oil	740 (Rc61)	750 (Rc62)	474 (Rc45)	320 (Rc27)

[a] All specimens were directly quenched from liquid carburizing bath at 1550 F and tempered at 350 F.
[b] See Fig. 1 and Table I for chemical composition and description of specimens.
[c] Values in parentheses are approximate Rockwell equivalent hardnesses.

TABLE IV.—RECOMMENDED LIMITS OF EACH SUPERFICIAL ROCKWELL SCALE.

Superficial Rockwell Hardness Scale	AISI Steel	Treatment[a]	Case Depth Limit, in.
15 N.......	1120.....	Oil quench	Up to 0.007
	1120.....	Water quench	Up to 0.004
	1112.....	Oil quench	Up to 0.007
	1112.....	Water quench	Up to 0.007
	1010.....	Oil quench	Up to 0.010
	1010.....	Water quench	Up to 0.007
30 N.......	1120.....	Oil quench	Above 0.006
	1120.....	Water quench	Above 0.003
	1112.....	Oil quench	Avove 0.006
	1112.....	Water quench	Above 0.005
	1010.....	Oil quench	Above 0.008
	1010.....	Water quench	Above 0.005
45 N.......	1120.....	Oil quench	Above 0.007
	1120.....	Water quench	Above 0.006
	1112.....	Oil quench	Above 0.010
	1112.....	Water quench	Above 0.006
	1010.....	Oil quench	...
	1010.....	Water quench	Above 0.008

[a] Direct quench from liquid-carburizing bath at 1550 F.

TABLE III.—SUPERFICIAL ROCKWELL HARDNESS ON SOME LIQUID CARBURIZED STEELS.

Case Depth, in.	AISI C1120												AISI C1010												AISI B1112											
	Rockwell Hardness, 15 N				Rockwell Hardness, 30 N				Rockwell Hardness, 45 N				Rockwell Hardness, 15 N				Rockwell Hardness, 30 N				Rockwell Hardness, 45 N				Rockwell Hardness, 15 N				Rockwell Hardness, 30 N				Rockwell Hardness, 45 N			
	350[a]	600	750	850	350	600	750	850	350	600	750	850	350	600	750	850	350	600	750	850	350	600	750	850	350	600	750	850	350	600	750	850	350	600	750	850
	WATER QUENCHED																																			
None........	77	76	76	68	52	52	51	46	38	38	36	29	49	49	46	46	<20	<20	<20	<20	Minus		Readings		62	62	60	57	32	32	28	28	<20	<20	<20	<20
0.001........	80	78	77	74	59	57	55	48	43	39	38	31	54	49	47	47	<20	<20	<20	<20					66	64	63	62	37	32	30	30	<20	<20	<20	<20
0.002........	83	82	80	77	64	61	60	53	44	41	39	34	61	53	51	51	<20	<20	<20	<20	↓	↓	↓	↓	73	68	67	66	47	39	34	33	<20	<20	<20	<20
0.003........	85	84	83	81	67	64	63	55	52	44	43	37	69	60	59	59	32	27	23	<20					76	74	73	70	50	45	39	38	<20	<20	<20	<20
0.004........	87	86	85	82	71	67	65	58	55	48	46	39	79	71	69	66	42	30	29	25	<20				83	79	77	75	56	52	43	41	51	26	23	<20
0.005........	88	87	86	84	73	68	66	60	58	50	49	43	83	77	76	71	48	38	36	33	<20	<20	<20	<20	86	83	80	78	61	57	47	45	40	31	30	<20
0.006........	90	88	87	85	76	70	67	61	61	53	51	44	87	82	80	75	53	43	38	35	<20	<20	<20	<20	88	85	82	81	65	62	52	50	46	34	33	<20
0.007........	91	89	88	85	78	71	68	63	63	55	53	45	90	84	82	78	60	48	42	37	<25	<20	<20	<20	91	87	84	83	69	65	57	54	53	37	36	<20
0.008........	92	89	88	86	80	72	69	65	65	57	55	47	91	86	84	81	68	55	48	42	43	26	<20	<20	92	88	85	84	73	68	61	58	58	43	40	<20
0.009........	92	89	88	86	81	73	70	66	68	60	56	48	91	88	86	83	73	61	56	50	51	33	29	25	92	89	86	84	76	70	64	61	61	48	46	25
0.010........	93	89	88	86	82	74	71	67	75	63	57	49	92	89	87	84	78	66	62	58	60	39	39	30	93	89	87	85	79	71	67	64	65	52	51	30
	OIL QUENCHED																																			
None........	64	64	61	58	30	30	30	28	<20	<20	<20	<20	46	46	43	40	<20	<20	<20	<20	Minus		Readings		57	57	55	54	26	26	26	25	<20	<20	<20	<20
0.001........	64	64	63	60	30	30	30	29	<20	<20	<20	<20	47	46	44	43	<20	<20	<20	<20					59	59	58	55	26	26	26	26	<20	<20	<20	<20
0.002........	66	66	66	65	36	36	34	33	<20	<20	<20	<20	50	48	47	46	<20	<20	<20	<20					61	60	59	58	27	27	27	27	<20	<20	<20	<20
0.003........	72	72	70	70	41	39	37	36	<20	<20	<20	<20	58	55	53	50	<20	<20	<20	<20					64	63	62	61	31	29	29	29	<20	<20	<20	<20
0.004........	77	77	75	73	48	44	41	40	21	21	21	20	66	62	59	56	26	21	<20	<20					68	67	65	64	34	32	32	32	<20	<20	<20	<20
0.005........	82	81	80	76	55	50	47	43	28	27	27	25	72	68	66	63	27	22	21	<20	↓	↓	↓		72	71	69	68	37	36	35	35	<20	<20	<20	<20
0.006........	85	83	81	78	60	55	52	46	33	30	30	28	78	73	71	68	28	26	22	20	<20	<20	<20		76	75	73	71	42	38	37	37	<20	<20	<20	<20
0.007........	87	85	84	81	65	59	57	50	35	35	35	30	81	78	76	72	45	40	36	32	<20	<20	<20	↓	78	77	76	75	46	40	39	38	<20	<20	<20	<20
0.008........	90	88	86	83	69	63	62	54	45	40	39	31	84	82	80	76	49	44	39	33	<20	<20	<20	<20	82	81	79	77	51	48	46	45	<20	<20	<20	<20
0.009........	91	89	87	85	72	66	65	57	52	45	42	40	88	85	83	79	55	49	44	39	27	<20	<20	<20	84	83	82	80	55	53	51	49	32	30	30	30
0.010........	91	89	87	86	76	69	67	62	57	50	44	43	92	87	85	82	64	54	50	47	36	<20	<29	<20	86	85	84	83	65	60	56	54	38	38	34	34

[a] Tempering temperatures (deg Fahr) (20-min tempers) used after direct quenching from carburizing bath (1550 F).

lation was developed by taking values from the average representative graphs worked out from the experimental data of which Figs. 4 and 5 are typical.

As shown in Table III, it can be seen that the type of steel, the treatment it receives, and the case depth govern and limit the particular superficial hardness scale that will give significant results for determining case depths. When selecting the superficial hardness scale to determine case depth of liquid-carburized parts made from C1010, B1112, and C1120 steels, the limits shown in Table IV should be considered. These limits are drawn where the resulting hardness appears to be insensitive to an increase in case depth.

The use of Rockwell superficial hardness values can be easily adopted as a nondestructive production test for con-

TABLE V.—EXPERIMENTAL DATA OF SUPERFICIAL ROCKWELL HARDNESS VALUES OF AISI C1010 GIVEN DIFFERENT TREATMENTS AFTER LIQUID CARBURIZING TO VARIOUS DEPTHS.

Average Case Depth, in.[a]	Average Superficial Rockwell Hardness Values[b]											
	15 N				30 N				45 N			
	Tempering Temperatures, deg Fahr[c]											
	350	600	750	850	350	600	750	850	350	600	750	850
Oil Quenched[d]												
Core	46	46	43	40	<20	<20	<20	M.R.	minus readings			
0.0017	47	47	48	45	<20	<20	<20	<20	minus readings			
0.0027	56	52	51	51	<20	<20	<20	<20	minus readings			
0.0036	64	..	58	58	<20	<20	<20	<20	minus readings			
0.0046	70	66	65	63	27	22	23	<20	minus readings			
0.0054	70	68	64	63	28	26	22	<20	minus readings			
0.0063	81	77	75	70	43	36	34	29	<20	minus readings		
0.0074	83	78	76	71	47	40	34	32	<20	<20	<20	M.R.
0.0086	87	84	82	77	57	50	44	38	27	<20	<20	<20
0.0103	90	87	85	82	66	52	52	48	37	<20	<20	<20
Water Quenched												
Core	49	49	46	45	<20	<20	<20	M.R.	minus readings			
0.0021	60	53	51	53	<20	<20	<20	<20	minus readings			
0.0031	71	61	62	60	32	27	23	<20	minus readings			
0.0039	79	72	68	64	42	30	29	25	<20	minus readings		
0.0042	81	76	74	69	46	35	35	30	<20	<20	<20	<20
0.0063	85	81	78	73	53	43	37	33	24	<20	<20	<20
0.0073	89	84	81	78	62	53	42	39	35	23	<20	<20
0.0079	90	85	84	80	65	55	51	45	41	26	<20	<20
0.0092	91	88	86	83	73	61	57	50	50	33	27	25
0.0102	92	89	87	85	79	66	63	59	61	39	39	30

[a] Each average case depth is the average of at least 25 effective total case depth determinations.
[b] Each average hardness value is the average of at least 50 determinations.
[c] All specimens were tempered in niter bath at various temperatures for 20 min.
[d] All specimens were directly quenched from liquid carburizing bath with 20.5 per cent NaCN at 1550 F.

TABLE VI.—EXPERIMENTAL DATA OF SUPERFICIAL ROCKWELL HARDNESS VALUES OF AISI B1112 GIVEN DIFFERENT TREATMENTS AFTER LIQUID CARBURIZING TO VARIOUS DEPTHS.

Average Case Depth, in.[a]	Average Superficial Rockwell Hardness Values[b]											
	15 N				30 N				45 N			
	Tempering Temperatures, deg Fahr[c]											
	350	600	750	850	350	600	750	850	350	600	750	850
Oil Quenched[d]												
Core	57	57	55	52	26	26	25	21	<20	<20	<20	<20
0.0021	62	60	63	62	26	27	28	28	<20	<20	<20	<20
0.0033	65	66	66	66	31	32	29	31	<20	<20	<20	<20
0.0039	68	68	70	68	34	33	34	34	<20	<20	<20	<20
0.0053	72	72	70	70	39	38	37	37	<20	<20	<20	<20
0.0056	71	71	72	70	37	36	36	39	<20	<20	<20	<20
0.0075	80	..	78	77	48	..	45	45	<20	<20	<20	<20
0.0083	82	80	81	77	53	52	51	47	<20	<20	<20	<20
0.0096	86	85	80	82	58	55	53	53	34	30	28	30
0.0103	87	87	84	83	64	62	58	57	39	38	34	34
Water Quenched												
Core	62	62	61	57	32	32	26	26	<20	<20	<20	<20
0.0021	73	68	67	68	46	36	36	37	<20	<20	<20	<20
0.0031	79	75	73	71	47	45	38	40	<20	<20	<20	<20
0.0042	84	80	76	75	57	54	44	45	31	26	23	<20
0.0048	85	80	77	77	60	58	44	45	36	32	32	<20
0.0059	88	85	82	82	63	57	52	48	45	33	35	<20
0.0066	90	86	86	83	70	64	61	55	50	40	37	<20
0.0088	92	88	88	84	75	65	64	60	57	45	46	<20
0.0096	92	88	89	85	78	70	67	62	63	48	53	25
0.0106	93	..	89	87	80	..	70	65	66	...	52	30

[a] Each average case depth is the average of at least 25 effective total case depth determinations.
[b] Each average hardness value is the average of at least 50 determinations.
[c] All specimens were tempered in niter bath at various temperatures for 20 min.
[d] All specimens were directly quenched from liquid carburizing bath with 20.5 per cent NaCN at 1550 F.

TABLE VII.—EXPERIMENTAL DATA OF SUPERFICIAL ROCKWELL HARDNESS VALUES OF AISI C1120 GIVEN DIFFERENT TREATMENTS AFTER LIQUID CARBURIZING TO VARIOUS DEPTHS.

Average Case Depth, in.[a]	Average Superficial Rockwell Hardness Values[b]											
	15 N				30 N				45 N			
	Tempering Temperatures, deg Fahr[c]											
	350	600	750	850	350	600	750	850	350	600	750	850
Oil Quenched[d]												
Core	64	64	61	58	30	30	32	30	<20	<20	<20	<20
0.0017	65	65	66	66	34	35	36	33	<20	<20	<20	<20
0.0030	72	74	71	71	39	40	37	37	<20	<20	<20	<20
0.0043	79	77	77	73	49	46	46	42	21	21	21	<20
0.0051	82	80	80	77	55	52	48	45	28	27	27	25
0.0055	83	80	81	79	55	51	51	49	30	30	28	25
0.0075	89	87	86	82	66	61	60	55	43	35	35	30
0.0081	89	86	85	82	66	60	60	53	45	38	39	30
0.0087	91	88	88	85	73	64	67	60	52	45	43	39
0.0106	92	89	88	86	77	70	69	64	61	49	47	44
Water Quenched												
Core	77	77	74	68	52	52	53	46	38	38	36	28
0.0017	82	81	81	77	63	60	59	50	46	39	39	31
0.0030	86	84	83	81	67	64	63	55	51	44	43	37
0.0043	90	86	85	83	73	67	65	57	56	50	48	41
0.0051	90	88	86	84	73	68	64	61	58	51	50	42
0.0055	90	88	88	84	75	69	66	61	58	51	50	43
0.0070	91	88	88	85	77	70	67	63	62	53	51	44
0.0080	92	89	88	86	79	71	70	64	65	57	55	47
0.0088	92	89	88	86	81	73	70	67	67	57	57	49
0.0106	92	89	88	86	82	75	71	68	77	60	56	50

[a] Each average case depth is the average of at least 25 effective total case depth determinations.
[b] Each average hardness is the average of at least 50 determinations.
[c] All specimens were tempered in niter bath at various temperatures for 20 min.
[d] All specimens were directly quenched from liquid carburizing bath with 20.5 per cent NaCN at 1550 F.

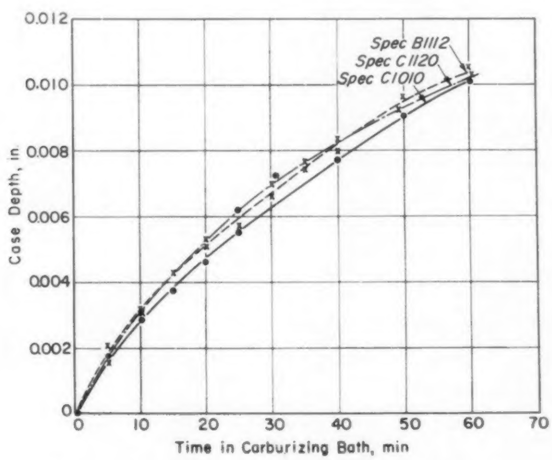

Fig. 6.—Time in carburizing bath versus case depth.

The carburizing bath with 20.5 per cent sodium cyanide content was held at 1550 F. Chemical analyses of the specimens showed them to have the composition specified in Table I.

TABLE VIII.—LIQUID CARBURIZED CASE DEPTH OF VARIOUS SPECIFICATIONS VERSUS TIME IN BATH.

Time, min.	Average Case Depth Determinations, in.[a]		
	AISI C1010[b]	AISI B1112[b]	AISI C1120[b]
5	0.0019	0.0021	0.0017
10	0.0029	0.0032	0.0030
15	0.0038	0.0040	0.0043
20	0.0044	0.0049	0.0053
25	0.0063	0.0057	0.0055
30	0.0073	0.0066	0.0070
35	...	0.0075	0.0075
40	0.0078	0.0085	0.0081
50	0.0088	0.0094	0.0088
60	0.0103	0.0105	0.0106

[a] Average case depth is the average of at least 25 determinations.
[b] All specimens were directly quenched from carburizing bath with 20.5 per cent NaCN at 1550 F.

trol of liquid-carburized case depths, provided the results of our findings are used similar to the following tabulation:

LIQUID CARBURIZED COMPONENTS[a]

Specification	Desired Case Depth, in.	Type of Quench	Temper, deg Fahr[b]	Hardness Limits	
				Data	Suggested
C1010	0.002 to 0.003	Oil	350	R 15 N 50 to 58	R 15 N 50 to 60
C1010	0.002 to 0.003	Water	350	R 15 N 61 to 69	R 15 N 60 to 70
B1112	0.005 to 0.007	Water	600	R 30 N 61 to 68	R 30 N 60 to 70
C1120	0.004 to 0.006	Oil	350	R 30 N 48 to 60	R 30 N 50 to 60

[a] Direct quench from 1550F.
[b] Twenty-minute tempers.

Although the research project was limited to the above-mentioned steels, the data obtained can be used to determine the case depths of other liquid carburized steel if the resulting core properties are known.

References

(1) J. K. McIver, "Salt Bath Carburizing," *Metal Progress*, Vol. 62, Dec., 1952, p. 85.
(2) Philip O'Keefe, "Salt Baths for Metal Treating," *Materials and Methods*, Vol. 34, Oct., 1951, p. 116.
(3) W. Adam, Jr., and L. B. Rosseau, "Modern Heat Treating," *Metal Progress*, Vol. 57, March, 1950, p. 332; April, 1950, p. 498; June, 1950, p. 765.
(4) International Nickel Co., "The Case Hardening of Nickel Alloy Steel" (1946).

PERSONALS...

News items concerning the activities of our members will be welcomed for inclusion in this column

The following longtime ASTM members recently completed fifty years of membership in the American Chemical Society: **P. H. Bates,** ASTM Past-President and Honorary Member, and retired chief, Clay and Silicate Products Div., National Bureau of Standards; **William Hamlin Cady,** editor, American Association of Textile Chemists and Colorists Technical Manual and Year Book; **Arno C. Fieldner,** ASTM Past-President and Honorary Member, and retired fuels technologist U. S. Bureau of Mines; **George A. Perley** retired associate director of research, Leeds & Northrup, Philadelphia, Pa., and **E. O. Slater,** president and manager, Smith-Emery Co., Los Angeles, Calif.

A. G. Ashcroft of Arthur D. Little, Inc., in New York, **Jules Labarthe, Jr.,** administrative fellow at Mellon Institute of Industrial Research, University of Pittsburgh, and **Herbert F. Schiefer,** physicist, textiles section, National Bureau of Standards, participated in a panel discussion on textile engineering and its place in industry during the 65th annual meeting of the American Society for Engineering Education in June at Cornell University in Ithaca, N. Y. All three gentlemen are active in ASTM Committee D-13 on Textile Materials.

José Aleman, formerly with the National Bureau of Standards, Plastics Section, Washington, D.C., is now associated with Departmento de Plasticos, Madrid, Spain.

ASTM Past-President **Herbert J. Ball,** professor of textile engineering Lowell Technological Inst., Lowell, Mass., received an honorary doctor of science degree from LTI. Currently honorary chairman of Committee D-13 on Textile Materials, Professor Ball served as its chairman for 20 years.

J. Lloyd Barron and **W. J. Krefeld** are the recently elected chairman and vice-chairman of the Construction Standards Board of the American Standards Assn., heading the technical work on building codes and construction standards under ASA procedures. Mr. Barron, who represents the American Public Health Assn. on the Board, is sanitary engineer and director of sanitation of the National Biscuit Co., New York City. Mr. Krefeld, who is professor civil engineering, Columbia University, and director of the research laboratories, represents ASTM on the Construction Standards Board.

John Betley, formerly chemical engineer, Interlectric Corp., Warren, Pa., is now associated with Lansdale Tube Co., Div. of Philco Corp., Lansdale, Pa., as senior engineer.

Lynn S. Beedle, for some time assistant director, Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa., has been named to full professorship in the Department of Civil Engineering.

Richard A. Biggs, formerly with Crucible Steel Co. of America, is now manager, architectural section, Electro Metallurgical Co., Div. of Union Carbide Corp., New York City.

Charles W. Blacketer, until recently with The McMurtry Mfg. Co., Denver, Colo., is now technical adviser, Sinclair & Valentine Co., Inc., Kansas City, Mo.

H. E. Bovay, Jr., consulting engineers, and R. F. Taylor, consulting engineer, recently combined to provide expanded professional civil, industrial, mechanical and electrical engineering, the organization to carry the name of H. E. Bovay, Jr., consulting engineers, with main office at 5009 Caroline St., Houston, Texas, and branches in Baton Rouge, La., and Spokane, Wash.

J. M. Buist, assistant manager, rubber service dept., Imperial Chemical Industries, Ltd., Blackley, Manchester, England, gave the 12th Foundation Lecture for the Institution of the Rubber Industry, in Manchester, in May. The lecture was entitled "Polymer Testing and Its Contribution to Developments in Industry."

ASTM Past-President **Arthur W. Carpenter,** retired manager of testing laboratories, B. F. Goodrich Co., Akron, Ohio, has been named to receive the Charles Goodyear medal of the American Chemical Society's Rubber Chemistry Division for outstanding contribution in the field. Presentation will be made at a dinner in New York City on September 12.

Dodd S. Carr has been appointed director of research for Bart Laboratories and Design, Inc., Belleville, N. J.

Joseph G. Christ, formerly metallurgist, Atomic Power Div., Westinghouse Electric Co., Pittsburgh, Pa., is now manager, materials and processes, International Business Machines Corp., Poughkeepsie, N. Y.

Irvin L. Cooter has been appointed chief of the Magnetic Measurements Section at the National Bureau of Standards, Washington, D. C. Mr. Cooter joined the NBS Staff in 1930. In ASTM he is active in Committee A-6 on Magnetic Properties.

Alton B. Crampton has been named the administrative head of a new technical unit the Esso Research and Engineering Co. (Linden, N. J.) has organized to advise European affiliates of the Standard Oil Co. (N. J.) on petrochemicals. Esso Research is the scientific affiliate of Jersey Standard.

Albert W. deNeufville has been promoted from assistant to associate professor, engineering mechanics department, Lehigh University, Bethlehem, Pa.

William A. Dupraw, formerly with the Armour Research Foundation, Technology Center, is now chief chemist, Columbia-National Corp., Pensacola, Fla.

Churchill Eisenhart, chief, statistical engineering laboratory, National Bureau of Standards, has been awarded the Department of Commerce Gold Medal for Exceptional Service, the highest employee honor of the U. S. Department of Commerce. The award recognized his "leadership in integrating modern statistical development with experimental research in the physical sciences, distinguished authorship, and outstanding contributions to the public service." Dr. Eisenhart is a member of the task group concerned with precision and accuracy of ASTM Committee E-11 on Quality Control of Materials.

Philip J. Elving, professor of chemistry at the University of Michigan, has been selected to receive the 1957 Anachem Award in Analytical Chemistry from the Association of Analytical Chemists, an affiliate society of the Detroit Section of the American Chemical Soceity. Presentation will be made in October at the Anachem Conference in Dearborn. Professor Elving will be cited for his many contributions and achievements in the field of analytical chemistry.

Roy W. Emerson, metallurgist, has been appointed assistant to the president and general technical coordinator, Pittsburgh Piping and Equipment Co., Pittsburgh, Pa. He has been active in the Steel Committee notably in work in pipes, tubing and valves for high-temperature service.

Glenn W. Geil, a metallurgist at the National Bureau of Standards, has been awarded the Department of Commerce Silver Medal for Meritorious Service, the award recognizing his "exceptional achievement in physical metallurgy, particularly in studies relating to the deformation of metals at subzero temperatures." Mr. Geil has served for several years as secretary of the Low Temperature Panel of the Joint ASTM-ASME Committee on Effect of Temperature on the Properties of Metals.

Omar J. Glantz, superintendent of the Penn-Dixie Cement Corp.'s Plant No. 10 at Petoskey, Mich., has been promoted to

(Continued on page 84)

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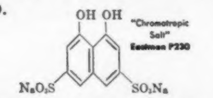

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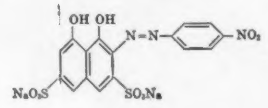
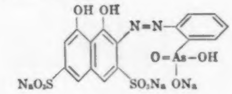


with which you can spot-test for borates, according to Feigl. Unless you need the exercise, that would be a little quixotic because you can buy the reagent as *4,5-Dihydroxy-3-(p-nitrophenylazo)-2,7-naphthalenedisulfonic Acid Disodium Salt* (Eastman 4411).

East of the Oder, meanwhile, they have been busy diazotizing *o-Arsanilic Acid* and coupling it with chromotropic acid (doubtless using exotic brands instead of Eastman 6747 and **Eastman P230**, respectively) to get



which democrat or monarchist can purchase as *3-(2-Arsonophenylazo)-4,5-dihydroxy-2,7-naphthalenedisulfonic Acid Trisodium Salt* (Eastman 7302, with the name slurred to "Arsenazo"). If he reads and believes scientific Russian, he may buy it for the determination of beryllium, rare earths (as a group), and aluminum in Al-Ni-Cr and Al-Mg alloys. (We'll supply the references, if asked.)

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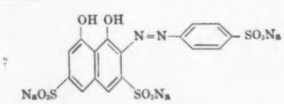

available as *4,5-Dihydroxy-3-(p-sulfophenylazo)-2,7-naphthalenedisulfonic Acid Trisodium Salt* (Eastman 7309, referred to by aficionados as "SPADNS"). It is an indicator for 1) the titration of thorium, 2) the complexometric titration of zirconium, 3) the titrimetric determination of micrograms of fluoride ions. (Abstract on request.)

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Personals

(*Continued from page 79*)

the position of director of research with headquarters at Nazareth, Pa.

H. H. Gorrie, vice-president in charge of engineering, Bailey Meter Co., Cleveland, Ohio, has been elected to the board of directors of his company.

William H. Graves, of the Department of Automotive Engineering, College of Engineering, University of Michigan, has been elected vice-president, American Forging and Socket Co., Pontiac, Mich., to succeed the late Frederick C. Anger. Professor Graves was appointed a director of the company last August.

Joseph B. Gutenkunst has been elected president-treasurer of Milwaukee Malleable and Grey Iron Works to fill the post left vacant by the death of his brother, **C. A. Gutenkunst, Jr.** Both men had shared general management of the firm since 1931.

Clarence H. Hahner, chief, Glass Section, National Bureau of Standards, has been awarded the Department of Commerce Silver Medal for Meritorious Service, recognizing his "very valuable contribution to the science and technology of optical glasses, and for important accomplishments in the development of many new complex glasses." Mr. Hahner has served on ASTM Committee C-14 on Glass and Glass Products for many years.

Charles O. Heath, Jr., formerly on the faculty of Oregon State College, Corvallis, is visiting professor of Rensselaer Polytechnic Institute at the University of Roorkee (India).

H. Bert Hood, formerly with Pittsburgh Testing Lab., Pittsburgh, Pa., has opened offices as professional engineer in Apollo, Pa.

Cdr. Harry J. Huester, USN, 25-year member of ASTM and ardent worker in various technical engineering societies, has been transferred from the Naval Air Station, Aeronautical Engineering Dept., Jacksonville, Fla., after a tour of four years. His new post is at the Naval Air Material Center, Philadelphia Navy Yard. This was formerly the Naval Aircraft Factory, which was the first in naval aviation, research and development. Cdr. Huester had his initial start at the Naval Aircraft Factory in 1918, under **Horace C. Knerr,** now president of Metlab Co., Philadelphia, Pa. A prime mover in organizing a Jacksonville Chapter of the American Society for Metals soon after he arrived there in 1953, Cdr. Huester was chairman of the ASM Southern Metals Conference in May. In ASTM he has been very active in Committees B-3 on Corrosion of Non-Ferrous Metals and Alloys, and B-7 on Light Metals and Alloys.

Miss Ruth Jago is now president of Thwing-Albert Instrument Co., Philadelphia, Pa., and **E. J. Albert** is chairman of the board. Miss Jago was formerly treasurer, and Mr. Albert, president. Mr. Albert who recently completed a three-year term as a director of the Society, serves on various technical committees and has been a staunch supporter of Philadelphia District activities.

J. Stuart Johnson was appointed dean of the College of Engineering, Wayne State University, Detroit, Mich., effective June 1, 1957.

Deane Brewster Judd, physicist, National Bureau of Standards, was the first recipient of the "Godlove Award for Contributions to the Knowledge of Color," presented by the Inter-Society Color Council at its 1957 annual meeting. Dr. Judd is a past-chairman of the Council—the only chairman to serve two terms. The Award, to be presented biennially, was established by Mrs. Godlove in memory of the late Dr. I. H. Godlove, also a chairman of the Council, and for many years editor of its *News Letter*.

Hugh F. Kennison, formerly chief engineer, has been elected vice-president in charge of engineering and research, Lock Joint Pipe Co., East Orange, N. J.

Verne Ketchum, formerly chief engineer, is now director of engineering, Timber Structures, Inc., Portland, Ore.

Ivo M. Kurg, until recently aeronautical research engineer, National Advisory Committee for Aeronautics, Structures Research Div., Langley Field, Va., is now

(*Continued on page 86*)

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FOR FURTHER INFORMATION CIRCLE 567 ON READER SERVICE CARD PAGE 113

Personals

(*Continued from page 84*)

senior metallurgical engineer, Curtiss-Wright Corp., Wright Aeronautical Div., Wood Ridge, N. J.

Howard L. Leventhal has been named assistant to manager, Visking Co., Chicago. He was formerly with Chicopee Mfg. Corp., Little Rock, Ark.

R. W. Loofbourow has joined Frank L. Crobaugh Co., Cleveland, Ohio, as manager of spectrographic laboratories. He was formerly with Utica Drop Forge and Tool Co.

James D. Mack has been promoted from assistant to associate professor, Lehigh University, Bethlehem, Pa.

W. E. Mahin, until recently management consultant, Cambridge, Ohio, is now president, Malleable Research and Development Foundation, Granville, Ohio.

G. Martin, formerly superintendent of research, London Advisory Committee for Rubber Research, London, England, is now superintendent, The British Rubber Producers' Research Assn., in the same city.

Frederic T. Mavis, for many years on the faculty of Carnegie Institute of Technology, Pittsburgh, Pa., is now dean of the College of Engineering, University of Maryland, College Park. Professor Mavis is a past-officer of ASTM Pittsburgh District Council.

Thomas P. May has been appointed manager of the International Nickel Co.'s Kure Beach-Harbor Island Testing Station on the North Carolina coast near Wilmington. This station, where research is conducted on the behavior of materials in salt water and sea air, is recognized as the most extensive project of its kind in the world. For a number of years head of the Corrosion Section, Chemistry Div., U. S. Naval Research Laboratory, Washington, D. C., Dr. May joined the Corrosion Engineering Section of Inco's Development and Research Div. in New York in 1947. Since 1954 he has been serving as technical manager of the testing station on the North Carolina Coast. He now will transfer headquarters from New York to the station, his new position combining both technical and operational management.

Louis C. McCabe, president of Resources Research, Inc., Washington, D. C. and **Leslie Silverman,** Harvard University School of Public Health, Cambridge, Mass., are among those appointed to serve on a National Advisory Committee on Community Air Pollution recently established by the U. S. Public Health Service, Department of Health, Education, and Welfare. Dr. McCabe is chairman of ASTM Committee D-22 on Methods of Atmospheric Sampling and Analysis, and Dr. Silverman is chairman of Subcommittee II on Methods of Sampling of Committee D-22.

Glenn H. McIntyre, international authority on ceramics and inorganic chemistry, has been appointed chairman of the board and general manager of National Spectrographic Laboratories, Inc., Cleveland, Ohio. For many years Dr. McIntyre had been associated with the Ferro Corp. until he assumed active management of NSL last December.

Howard F. McMurdie, chief, Constitution and Microstructure Section at the National Bureau of Standards, has been awarded the Department of Commerce Silver Medal for Meritorious Service, recognizing his "valuable contributions to the science of crystal chemistry and very valuable leadership in the development of a comprehensive program of work in this field."

Louis A. Patronsky of Minneapolis, one of the nation's leading authorities on wood technology, has been named product development engineer for Pack River Tree Farm Products, Spokane, Wash., and affil-

(*Continued on page 88*)

Personals

(*Continued from page 86*)

iated lumber manufacturers in Idaho, Montana, and British Columbia. For the past four years he has been director of product development for Wabash Screen Door Co., Minneapolis.

Harry W. Pierce, vice-chairman of the board of New York Shipbuilding Corp., Camden, N. J., has been elected president of The Engineers' Club of Philadelphia.

Kenneth Pitney has been appointed to the position of manager, industrial sales and engineering, The J. M. Ney Co., Hartford, Conn. Mr. Pitney had been a member of the Industrial Division for seven years.

Francis T. P. Plimpton, Jr., until recently with Thwing-Albert Instrument Co., Philadelphia, Pa., is now associate editor, *The Iron Age*, in the same city.

Fred L. Plummer resigned as director of engineering of Hammond Iron Works, and accepted a position as national executive secretary and technical director, American Welding Society, New York City.

Michael Powsner, formerly materials engineer, U. S. Testing Co., Hoboken, N. J., is now on the faculty of Bennington High School, Bennington, Vt., as science teacher.

Raymond A. Quadt was named director of research and development for Bridgeport Brass Co., Bridgeport, Conn. He continues as vice-president of research and development of Hunter Douglas Aluminum Corp., Riverside, Calif., acquired last year by Bridgeport Brass.

G. F. Roquemore has been named vice-president, Midcontinent Adhesive Co., Div. of Minnesota Mining & Mfg. Co., Detroit, Mich. Until recently he was with the Midcontinent Chemical Co., Grove City, Ohio.

R. L. Roshong, formerly with Taylor Forge and Pipe Works, Chicago, Ill., is now chief metallurgist, Cameron Iron Works, Inc., Houston, Texas.

George Sachs, professor of Metallurgical engineering and associate director, Syracuse University Research Institute, Syracuse, N. Y., recently was honored by two German societies. He was awarded the Gaussmedal by the Academy of Technical Sciences in West Germany in recognition of his outstanding achievements regarding the development of the general and applied science of metals, mechanical metallurgy, and technology of structural materials. The second award, the Heyn medal, the highest award of the German Society of Metals, recognized Dr. Sachs' major contributions to the introduction of X-rays as scientific tool, and specifically his analyses of steel hardening, precipitations, and coldwork. Dr. Sachs received the Gold Medal of the American Society for Metals in 1953.

Erle I. Shobert II, manager, research and engineering, Carbon Div., Stackpole Carbon Co., St. Marys, Pa., received an honorary degree of doctor of science at the Ninety-Ninth Annual Commencement, Susquehanna University, Selinsgrove, Pa., on June 1. Currently chairman of Committee B-4 on Metallic Materials for Electrical Heating, Electrical Resistance, and Electrical Contacts, and long active in this group, Mr. Shobert was recipient of an ASTM Award of Merit in 1953, recognizing valued contributions.

Victor Siegfried, chief engineer, The Ansonia Wire and Cable Co., Ashton, R. I., has been transferred to the grade of Fellow in the American Institute of Electrical Engineers "for contributions to the field of dielectrics and cable insulation."

C. A. Smith has been made executive vice-president of Mexico Refractories Co., Mexico, Mo., continuing as chief engineer.

T. R. Stevens, formerly with A. M. Kinney, Inc., Cincinnati, Ohio, is now general manager, Newton County Stone Co., Kentland, Inc.

(*Continued on page 90*)

Personals

(Continued from page 88)

Daniel V. Terrell retired July 1 as dean of the College of Engineering of the University of Kentucky. He had been a member of the faculty since 1912.

Percival Theel, director of research, Philadelphia Textile Institute, received a degree of doctor of textile science at the commencement exercises of the Philadelphia Textile Institute. Professor Theel has been a member of Committee D-13 on Textile Materials for many years and also serves on the Philadelphia District Council.

ASTM Past-President **John R. Townsend,** director of material and standards engineering, Sandia Corp., Albuquerque, N. M., has been nominated to the vice-presidency of the Board of Directors of the American Standards Assn. for the coming year.

George Warren has been appointed ceramist assistant to the works manager, The Pfaudler Co., Rochester, N. Y. Mr. Warren, who joined Pfaudler in 1952, will coordinate the over-all glassing and glass manufacturing operations of the Rochester division.

Chester M. White, formerly with Genesee Research Corp., is now manager, automotive products, research and development, Olin Mathieson Chemical Corp., Rochester, N. Y.

Thomas H. Wickenden, who retired in 1954 as vice-president of The International Nickel Co., Inc., and manager of its development and research division, received the honorary degree of doctor of science at the 116th annual Commencement Exercises of Denison University. The degree was conferred in recognition of Mr. Wickenden's substantial contributions in the field of metallurgy.

Albert C. Zettlemoyer, professor of chemistry and research director of the National Printing Ink Institute at Lehigh University, has been selected to present the annual Joseph J. Mattiello Lecture at the 35th Annual Meeting of the Federation of Paint and Varnish Production Clubs to be held October 30 through November 2, 1957, at the Bellevue-Stratford Hotel, Philadelphia, Pa. The title of his lecture will by "The Pigment-Vehicle Interface."

Standard Samples

National Bureau of Standards Circular 552, U. S. Government Printing Office, Washington 25, D. C., 24 cents.

THIS CATALOG lists the reference materials issued by the National Bureau of Standards and provides information on their procurement. Of the more than 500 standard samples of metals, ores, ceramics, chemicals, and hydrocarbons available, 275 are certified for chemical composition. Recent additions include a number of radioactive materials for use in nuclear physics, biochemistry, etc.

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The complement of glassware included with complete cabinets consists of 4 Glass Troughs, 645 mm long x 35 mm wide, with round bottom, capacity approximately 245 ml; 4 Anchor Rods, effective length 590 mm, diameter 8 mm, with bent ends for convenient handling; 8 Anti-Siphon Rods, 650 mm long x 7 mm diameter, with glazed ends; and two Glass Trays, Pyrex brand glass, 18 x 12 x 2½ inches inside depth. Complete cabinets also include a plastic rod to prevent tipping of troughs, 24 Paper Clips of Stainless steel, 6 Neoprene Stoppers, size No. 00, 6 ft. Neoprene tubing, ¼-inch bore, to drain cabinet, and Pinchcock, 3¼ inch size. Height overall, with cover closed, 31¼ inches.

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NEW MEMBERS . . . . . .

The following 205 members were elected from April 16 to June 17, 1957 making the total membership 8995 . . . . . Welcome to ASTM

Note—Names are arranged alphabetically—company members first then individuals—Your ASTM Year Book shows the areas covered by the respective Districts

CHICAGO DISTRICT (5)

Judsen Rubber Works, Inc., Donald B. Judsen, vice-president, 4107 W. Kinzie St., Chicago 24, Ill.

Metal Coating Corp., Paul S. Dougherty, president, 1217 W. 37th St., Chicago 9, Ill.

Bailey, Floyd, chief engineer, The Process Labs., A. O. Smith Corp., Route 49, S., Kankakee, Ill.

Blackburn, Andrew F., technical supervisor, Appleton Woolen Mills, Box 438, Appleton, Wis.

Cleare, Eldred G. chemical laboratory supervisor, Minneapolis-Honeywell Regulator Co., 2753 4th Ave., S., Minneapolis 8, Minn.

Cooper, Margaret M., professor, Home Economics, Clothing and Textiles, University of Wisconsin School of Home Economics, Madison 6, Wis.

Dahlen, Milton L., specification writer, Hammel & Green, Inc., 1932½ University Ave., St. Paul 4, Minn.

Drapeau, Joseph E., Jr., technical director, Glidden Co., Chemicals-Pigments-Metals Div., Box 309, Hammond 1, Ind. For mail: 1717 Summer St., Hammond 1, Ind.

Falk, Tage, chief engineer, Smith Welding Equipment Corp., 2633 4th St., S.E., Minneapolis 14, Minn.

Fleisch, Alfred G., chief chemist, Pfister & Vogel Tanning Co., 1531 N. Water St., Milwaukee 1, Wis.

Hognestad, Eivind, technical director, Marquette Cement Manufacturing Co., 20 N. Wacker Dr., Chicago 6, Ill.

Kaelble, David H., chemist, Minnesota Mining and Manufacturing Co., Central Research Dept., 2301 Hudson Rd., St. Paul 6, Minn.

Lattimer, Charles T., manager, Chemical and Physical Labs., RCA Victor, 3301 S. Adams St., Marion, Ind.

Leeper, W. A., chief metallurgist, The Oliver Corp., Plant 1, 533 Chapin, South Bend, Ind.

Lund, Clarence E., professor of mechanical engineering, University of Minnesota, Mechanical Engineering Dept., Minneapolis 14, Minn.

Nelson, Richard E., Jr., owner, H. H. Holmes Testing Laboratory, 3947 N. Spaulding Ave., Chicago 18, Ill.

Pfeiffenberger, Lucas E., graduate student, ceramic engineering, University of Illinois, 204 Ceramics Bldg., Urbana, Ill. [A] *

Sargeant, James A., vice-president, Container Laboratories, Inc., 112 W. Kinzie St., Chicago 10, Ill.

Smith, Rockwell, research engineer-roadway, Association of American Railroads, 3140 S. Federal St., Chicago 16, Ill.

Stewart, Dair J., chemist (control), U.S. Rubber Co., S. Forrest St., Stoughton, Wis. [A]

Storey, O. H., Jr., engineer, 755 E. Northmoor Dr., Lake Forest, Ill.

Stranberg, Don F., chief engineer, Anchor Coupling Co., Inc., Libertyville, Ill.

Welton, Herbert A., general superintendent of construction, W. A. Klinger, Inc., 2101 McDonald, Sioux City, Iowa.

Westby, S. H., manager, Housing and Cement Products Bureau, Portland Cement Assn., 33 W. Grand Ave., Chicago 10, Ill.

Zaricki, Wasyl, manager of engineering, The Gudeman Co., 340 W. Huron St., Chicago 10, Ill.

CLEVELAND DISTRICT (4)

Eaton Stamping Div., Eaton Manufacturing Co., Frank Kramen, product engineer, 17877 St. Clair Ave., Cleveland 10, Ohio.

Gow, James T., Sr., vice-president, in charge of manufacturing and engineering, Sandusky Foundry and Machine Co., Sandusky, Ohio.

Reardon, Leslie J., associate professor of civil engineering, Case Institute of Technology, 10900 Euclid Ave., Cleveland 6, Ohio.

Vogel, Ralph B., chief chemist and chemical engineer, The National Lime and Stone Co., Carey, Ohio.

DETROIT DISTRICT (6)

Beach, Willis J., chemist, Technical Service Dept., Sugar Beet Products Co., 302 Waller St., Saginaw, Mich.

Brady, T.E., ceramic engineer, Surface Combustion Corp., 2375 Dorr St., Toledo 1, Ohio.

Compton, Ell Dee, research director, Eagle Ottawa Leather Co., 200 N. Beech Tree St., Grand Haven, Mich.

Grant, James S., chief chemist, Toledo Edison Co., 1401 Front St., Toledo 5, Ohio.

Leary, Paul E., technical director, Wolverine Finishes Corp., 836 Chicago Dr., Grand Rapids, Mich.

Mares, Nicolas, president, Cummings-Moore Graphite Co., 1646 N. Green Ave., Detroit 9, Mich.

Morgenroth, Dan E., manager, General Construction Materials, Owens-Corning Fiberglas Corp., National Bank Bldg., Toledo 1, Ohio.

Mosher, L. W., civil engineer, 14050 W. McNichols Rd., Detroit 35, Mich.

Tache, Arthur J., Metallurgy Dept., Chrysler Corp., 12800 Oakland Ave., Highland Park 3, Mich. For mail: 203 W. Buena Vista, Highland Park 3, Mich.

NEW ENGLAND DISTRICT (13)

Production Specialties, Inc., Edward W. Hitchcock, chemist, 755 Boylston St., Boston 16, Mass.

Finkelstein, Martin I., laboratory director, National Felt Co., Mechanic St., Easthampton, Mass. For mail: 53 Westfield Rd., Holyoke, Mass.

Flynn, Francis A., chemist, Ansonia Mills, Inc., East Taunton, Mass.

Gaddes, Wesley Austin, chemist, Claremont Waste Manufacturing Co., Main St., Claremont, N. H. [A]

Wescott, Emery N., research librarian, Monsanto Chemical Co., Special Projects Dept., Everett 49, Mass.

Wundt, B. M., structural engineer, General Electric Co., Broad St., Fitchburg, Mass.

NEW YORK DISTRICT (1)

Allied Chemical and Dye Corp., Central Research Lab., George Kazan, principal engineer, Box 309, Morristown, N. J.

Barstow, Milligan & Vollmer, Vladimir Barstow, partner, 110 W. 42nd St., New York 36, N. Y.

General Electric Co., Large Steam Turbine-Generator Dept., C. J. Boyle, turbine materials engineer, 273 North Ave., Schenectady 5, N. Y.

International Business Machines, Inc., Electric Typewriter Testing Lab., F. C. Kruckas, test manager, Neighborhood Rd., Kingston, N. Y.

Minerals and Chemicals Corporation of America, C. Y. Haas, manager of adsorbent sales, Menlo Park, N. J.

Thomas & Betts Co., Inc., The, J. N. Frey, specifications and test manager, 36 Butler St., Elizabeth, N. J.

(Continued on page 96)

* [A] denotes Associate member.

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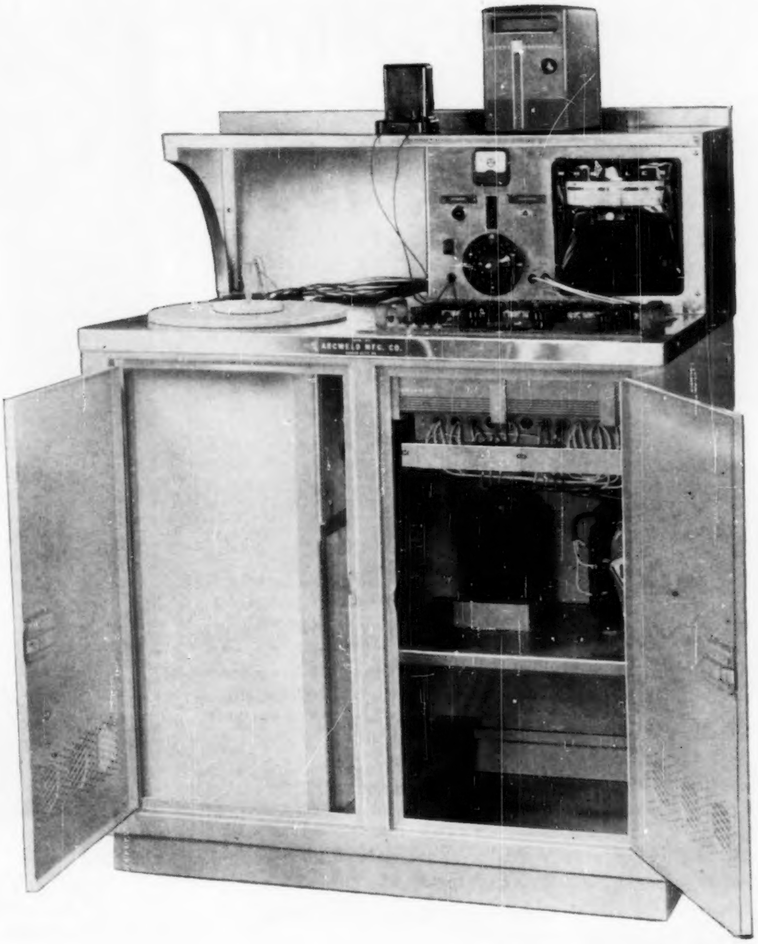

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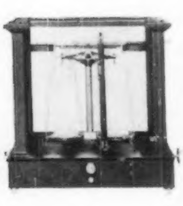

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New Members

(Continued from page 92)

Blattenberger, J. William, section leader, Cities Service Research and Development Co., Product Development Lab., Box 402, Cranbury, N. J.

Canada, Harold B., chief chemist, Utica Drop Forge and Tool Co., Metals Div., Utica, N. Y.

Dahlberg, Sigfrid, supervisor, Laboratory of Industrial Hygiene, Fidelity and Casualty Co., 80 Maiden Lane, New York 38, N. Y.

De Gennaro, Raymond, research engineer, Republic Aviation Corp., Farmingdale, N. Y. For mail: 10 Garfield Ave., Farmingdale, N. Y. [A]

Franceschini, Victor W. J., metallurgist, General Precision Laboratory, Inc., Pleasantville, N. Y. For mail: 421 N. Bedford Rd., Bedford Hills, N. Y.

Frendock, Charles, design engineer, G. V. Controls, Inc., 45 Hollywood Plaza, East Orange, N. J.

Greenfield, Jack, research director, Tung Research and Development League, Poplarville, Miss. For mail: Box 421, Lyndhurst, N. J.

Hammond, George P., construction engineer, U. S. Dept. of the Army, Corps of Engineers, Bldg. T112, Plattsburg A.F.B., Plattsburg, N. Y. For mail: 9 Peru St., Plattsburg, N. Y.

Hanover, Clinton D., Jr., owner, Hardesty & Hanover, Consulting Engineers, 101 Park Ave., New York 17, N. Y.

Hutton, W. L., T. Shriver and Co., Inc., Hamilton St., Harrison, N. J.

Kalish, Herbert S., engineering manager, Sylvania-Corning Nuclear Corp., Box 59, Bayside, L. I., N. Y.

Kirwan, Kenneth K., research engineer, Raymond Concrete Pile Co., 140 Cedar St., New York 6, N. Y. For mail: 450 Wastena Terrace, Ridgewood, N. J.

Krantz, Leon, building research engineer, New York State Building Code Commission, 1740 Broadway, New York 19, N. Y.

Loeb, Sigbert, 120 Liberty St., New York 6, N. Y.

Lubahn, Jack D., mechanics of materials engineer, General Electric Co., Schenectady, N. Y.

May, Thomas P., technical manager, Kure Beach, Harbor Island Testing Stations, The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

McKnight, Robert N., chief engineer, Wire and Insulations, The Acme Wire Co., P. O. Drawer M., Hamden Branch, New Haven 14, Conn.

Nordquist, David F., assistant chief chemist and research engineer, North American Cement Corp., Box 31, Catskill, N. Y.

Paul, Herman L., Jr., chief engineer, P-K Industries, Inc., 27 Porete Ave., N. Arlington, N. J.

Powers William J., supervisory materials engineer, Picatinny Arsenal, Dover, N. J.

Reed, George H., manager, chemical equipment and plastics, American Hard Rubber Co., 93 Worth St., New York 13, N. Y. For mail: 380 Cedar Hill Ave., Wyckoff, N. J.

Rice, Philip K., manager, Works Engineering Dept., Linde Co., 30 E. 42nd St., New York 17, N. Y.

Schad, James A., engineer, American Iron and Steel Inst., 150 E. 42nd St., New York 17, N. Y. For mail: 174 Harvard Ave., Rockville Centre, L. I., N. Y.

Schaul, J. S., Jr., chief engineer, Alpha Plastics, Inc., 78 Okner Parkway, Livingston, N. J.

Schenectady, City of, W. Alexander, purchasing agent, Bureau of Purchase, Schenectady, N. Y.

Silberfeld, Nathan, manager, Engineering Electroswitch Div., Tung-Sol Electric, Inc., 95 8th Ave., Newark 4, N. J.

Strasser, Alfred A., materials group leader, Nuclear Development Corp. of America, 5 New St., White Plains, N. Y.

Swartwood, Gerald L., materials engineer, Bryant Electric Co., Bridgeport, Conn.

Teicholz, Jacqueline H., proprietor, J. A. Teicholz Co., 744 Broad St., Newark N. J.

NORTHERN CALIFORNIA (8)

Hastings, Fred L., partner, Murphy & Hastings, Civil Engineers, 650 El Camino Real, Redwood City, Calif.

Koenitzer, Lester, materials engineer, Concrete Paving Evaluation Section, U. S. Army Engineer District, U. S. Corps of Engineers, Sacramento, Calif. For mail: 747 Oak Ave., Davis, Calif.

Long, Leonard O., director, Soils Dept., Abbot A. Hanks, Inc., 624 Sacramento St., San Francisco 11, Calif. For mail: 2712 Otis Dr., Alameda, Calif.

Maurer, J. G., chief chemist, Sacramento Lab., Southern Pacific Co., Sacramento 14, Calif.

OHIO VALLEY DISTRICT (15)

Bates, J. M., engineer, Carbide and Carbon Chemicals Co., 437 McCorkle Ave., S. Charleston, W. Va.

Schippereit, George H., assistant chief, Nonferrous Metallurgy Div., Battelle Memorial Inst., 505 King Ave., Columbus 1, Ohio.

Simmons, Franklin Allen, senior engineer, Bridge Dept., West Virginia State Road Commission, 207 Oney St., Charleston 1, W. Va.

Wentling, William H., chief product engineer, Lau Blower Co., 2007 Home Ave., Dayton 7, Ohio.

(Continued on page 98)

HARSHAW SCIENTIFIC

SPOTLIGHTS Centrifuges

Two new centrifuges have been added to our already extensive line of International centrifuges. The new HT for high speed centrifuging and the new CM, a cabinet unit, for routine moderate speed work. The HT high speed centrifuge provides speeds to 17,000 r.p.m., with forces to 34,390 x G and is designed for maximum safety to operating personnel. The CM centrifuge features great adaptability at moderate price. This attractively designed unit accommodates 23 heads and accessories for any routine application.

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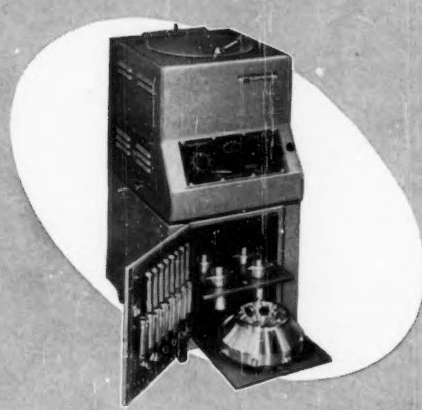
H-9985—International Model HT, with steel guard bowl, complete instrumentation and 8-place angle head for 50 ml tubes (without tubes). For operation on 115 volts, 50/60 cycles, single phase **$745.00**



H-8800—International Size 1, Model CM, with stainless steel guard bowl, autotransformer controller, electric tachometer and timer but without head, shields or cabinet floor stand; 115 volts, 50/60 cycles **$475.00**

H-8500—
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H-8858—Size 1, SBV
Routine and Research

H-9506—Size 2, V
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H-9875—Model PR-2
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FOR FURTHER INFORMATION CIRCLE 581 ON READER SERVICE CARD PAGE 113

New Members

(Continued from page 96)

PHILADELPHIA DISTRICT (2)

Bergey, Elmer E., chemist, National Casein Co. of New Jersey, Riverton 9, N. J.
Bowen, J. Hartley, Jr., superintendent, High Polymer Div., Aeronautical Materials Lab., Naval Air Material Center, Philadelphia 12, Pa. For mail: 547 Woodland Ave., Haddonfield, N. J.
Foulkes, Thomas G., assistant chief metallurgist, Bethlehem Steel Co., Bethlehem, Pa.
Fox, K. M., chemical research, Scott Paper Co., Chester, Pa.
Giordano, Fred, owner, K. G. M. Machine and Tool Co., 1621 Pearl St., Philadelphia 3, Pa.
Hepburn, William James, quality control engineer, Lukens Steel Co., Coatesville, Pa.
Hollander, Janet, research librarian, Dixie Cup Co., Easton, Pa.
Hunter, Calvin K., materials engineer, The Liberty Corp., 1518 Walnut St., Philadelphia, Pa. For mail: 413 Manor Rd., Hatboro, Pa.
Juppenlatz, John W., secretary-treasurer, Quaker Alloy Casting Co., Myerstown, Pa.
Rowland, J. Wallace, Jr., director of research, Victor Balata and Textile Belting Co., 25th and Freemansburg Ave., Easton, Pa.
Shenk, Robert H., chief engineer, Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia 32, Pa. For mail: Union Meeting Rd. and Midway Lane, Blue Bell, Pa.
Sobatzki, Raymond J., quality control superintendent, Rohm & Haas Co., 5000 Richmond St., Philadelphia 37, Pa. For mail: 631 Custis Rd., Glenside, Pa.

PITTSBURGH DISTRICT (3)

American Steel Band Co., H. B. Bowman, vice-president, operations, Box 565, Pittsburgh 30, Pa.
Magnetics, Inc., W. I. Lewis, research engineer, Butler, Pa.
Molded Fiber Glass Tray Co., A. W. Levenhagen, president, Box 128, Linesville, Pa.
Baumgarten, W. J., service metallurgist, U.S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 19, Pa. For mail: 1901 Bigelow Apts., Pittsburgh 19, Pa.
Boyd, James C., city engineer, Department of Public Works, City Bldg., Wheeling, W. Va.
Cremisio, Richard S., research metallurgist, Crucible Steel Co. of America, Research and Development Lab., 234 Atwood St., Pittsburgh 13, Pa. [A]
Fitzpatrick, Benjamin, ~~assistant~~ manager, Penn Bolt and Nut Co., McKees Rocks, Pa. For mail: R. D. 2, Wexford, Pa.
Harvey, Donald T., chief of physical testing, Kaiser Aluminum and Chemical Corp., Ravenswood Works, Ravenswood, W. Va.
Heck, Henry L., president, Penn Builders Supply Co., 151 W. 4th Ave., Tarentum, Pa.
Hunter, Elbert C., maintenance metallurgist, U. S. Steel Corp., Homestead Works, Munhall, Pa.
Lefebvre, Maurice J., technical director, R. D. Werner Co., Inc., Osgood Rd., Greenville, Pa.
McKenna, Paul J., technical representative, United States Steel Corp., Rm. 1007, 525 Wm. Penn Pl., Pittsburgh 30, Pa.
Meola, Warren D., civil engineer, Dravo Corp., Liberty and 5th Sts., Pittsburgh 22, Pa. For mail: 1500 W. Ingomar Rd., Pittsburgh 37, Pa. [A]
Morgan, William J., metallurgist, Alco Products, Inc., Gertrude St., Latrobe, Pa.
Seens, William B., Physical Metallurgy Dept., United States Steel Corp., Fundamental Research Lab., Research Center, Monroeville, Pa.
Toolin, P. R., research engineer, Westinghouse Research Labs., Westinghouse Electric Corp., Churchill Borough, Pittsburgh 35, Pa.

ST. LOUIS DISTRICT (9)

Reynolds Manufacturing Co., Clifford G. Cain, chief engineer, 600 N. Prospect St., Springfield, Mo.
Dietzel, J. J., microbiologist, Buckman Laboratories, Inc., 1256 N. McLean Blvd., Memphis 8, Tenn.
Lawson, George, district manager, Pittsburgh Testing Laboratory, 308 Gossitt Pl., Memphis 5, Tenn.
Ross, Richard T., microbiologist, Buckman Laboratories, Inc., 1256 N. McLean Blvd., Memphis 8, Tenn.
St. Louis County, Highway Div., John J. Leslie, county highway engineer, 115 N. Meramec Ave., Clayton 5, Mo.
Wienert, Lester A., chemist, Buckman Laboratories, Inc., 1256 N. McLean Blvd., Memphis 8, Tenn.

SOUTHERN CALIFORNIA DISTRICT (7)

Allen, Jack, A., secretary-manager, Concrete Masonry Assn., 5205 Hollywood Blvd., Los Angeles 27, Calif.
Anson, John Hahn, radiation physicist, Southern California Cancer Center, 1407S. Hope St., Los Angeles 15, Calif.
Breidenbach, Lloyd, J., assistant general manager and chief engineer, Narmco Resins and Coatings Co., 600 Victoria St., Costa Mesa, Calif.
Brenner, Harry S., president, Almay Research and Testing Co., 429 S. Western Ave., Los Angeles 5, Calif.
Hiller, Vernon T., principal engineer, Hiller & Wiese, Inc., 301 Moronet Bldg., Bakersfield, Calif.
Hitt, W. C., assistant chief of quality control, Douglas Aircraft Co., 3000 Ocean Park Blvd., Santa Monica, Calif. For mail: 14808 Oxnard St., Van Nuys, Calif.
Jacobson, Francis S., metallurgical engineer, research and development, Kaiser Steel Corp., Fontana, Calif. For mail: 132 E. Rosewood Court, Ontario, Calif.
Kemp, J. Wesley, development division manager, Applied Research Laboratories, 3717 Park Pl., Glendale 8, Calif.
Piscopo, Floyd A., chief test engineer, Narmco, Inc., 1882 Moore St., San Diego 1, Calif.
Skene, William T., group leader, Structures Methods, North American Aviation, Inc., Missile Development Div., 12214 Lakewood Blvd., Downey, Calif. For mail: 730 Elden Ave., Whittier, Calif.
Stubbs, Allan H., president, Western Concrete Structures Co., Inc., 2731 N. Beverly Glen Blvd., Los Angeles 24, Calif.
Todhunter, H. A., mechanical engineer, Department of Water and Power, Box 3669 Terminal Annex, Los Angeles 54, Calif.

SOUTHWEST DISTRICT (16)

Merichem Co., The, Division of Jefferson Lake Sulfur Co., Charles J. Kresch, chief chemist, Box 9788, Houston 15, Tex.
OTM Corp., Kenneth H. Bradshaw, vice-president and general manager, Box 19296, Houston 24, Tex.
Petroleum Chemicals, Inc., A. L. Wright, chief chemist, Box 1522, Lake Charles, La.
Texas Portland Cement Co., Kent B. Diehl, Sr., president, Box 1128, Orange, Tex.
Big Spring, City of, Clifton N. Bellamy, city engineer, Engineering Dept., Box 391, Big Spring, Tex.
Bozant, Burleigh A., vice-president, in charge of manufacturing, OTM Corp., Box 19296, Houston 24, Tex.
Bucknall, Eric Herbert, professor, University of Texas, College of Engineering, Austin 12, Tex. For mail: 512 E. 39th St., Austin 5, Tex.
Dehn, George L. C., southwestern manager, Magnaflux Corp., Box 35267, Dallas 35, Tex. For mail: 3313 Wentwood Dr., Dallas 25, Tex.
Dorcas, K. E., chief chemist, Convair, Division of General Dynamics Corp., Engineering Test Lab., Grants Lane, Fort Worth 1, Tex.
Fariss, Robert Elwyn, supervisor, Bentone Labs., Baroid Div., National Lead Co., Box 1675, Houston 1, Tex.
Lightfoot, R. Pat., senior nuclear engineer, Nuclear Program, Dept. 6-8, Convair, Fort Worth Div., Engineering Annex Bldg., No.

(Continued on page 101)

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FOR FURTHER INFORMATION CIRCLE 583 ON READER SERVICE CARD PAGE 113

Sargent

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The 0.01° C. Sargent Constant Temperature Water Bath, which is employed in many laboratories throughout the world where a precise, reliable thermostat is required, is now being supplied with an improved relay unit and heating system. The central heating and circulating unit of the bath is now equipped with three cylindrical heating elements rated at 200, 300 and 400 watts respectively. The 200 watt heater is controlled by the No. 81835 mercurial thermoregulator through a thyratron tube and saturable core reactor in the relay unit. (The use of a saturable core reactor obviates the difficulties commonly encountered with mechanical relaying systems such as pitted contacts, broken moving parts an freezing.) By means of a control mounted on the panel of the relay the output of this heater can be varied from the full 200 watts to approximately 60 watts, thus permitting such adjustment of the heater output that positive overshooting of the regulatory temperature is minimized. With the improved relay system this bath can be adjusted to a precision of ±.005° C. when operating in the vicinity of 25° C.

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Maximum power consumption 1100 watts.
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SOUTHWESTERN DIVISION, 5915 PEELER STREET, DALLAS 35, TEXAS
SOUTHEASTERN DIVISION, 3125 SEVENTH AVE., N., BIRMINGHAM 4, ALA.

CIRCLE 584 ON READER SERVICE CARD PAGE 113

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tests will give you the facts

MODEL DMC

Greater accuracy and reproducibility achieved with new modulated temperature control.

Accuracy in test results is greatly increased in the new DMC Weather-Ometer by a positive control of specimen temperatures.

A constant volume of air at a controlled temperature in the heavily insulated cabinet, maintains uniform predetermined specimen temperatures regardless of variations in room conditions.

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All automatic controls including complete voltage controls are located on the front panel of the Weather-Ometer directly above the door of the test chamber.

Both horizontal and vertical testing is available. Shallow containers are used for semi-liquid materials and vertical panels for solid materials.

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CIRCLE 585 ON READER SERVICE CARD PAGE 113

New Members

(*Continued from page 98*)

1, Fort Worth 16, Tex. For mail: 6408 Kirkwood Rd., Fort Worth 16, Tex.

Okon, Leonard W., manager, sales technical services, Kerr-McGee Oil Industries, Inc., Box 1031, Cushing, Okla.

Pfeiffenberger, George W., executive vice-president, Plains Cotton Growers, Inc., 220-221 Lubbock National Bldg., Lubbock, Tex.

Smith, R. V., works engineer, Carbide and Carbon Chemicals Co., Box 471, Texas City, Tex.

Victoria, City of, D. R. Voelkel, city engineer, Engineering Dept., City Hall, Victoria, Tex.

WASHINGTON D. C. DISTRICT (14)

Charlotte, City of, Engineering Dept., L. C. Cheek, Jr., city engineer, 600 E. Trade St., Charlotte, N. C.

Ferguson, H. F., head of lab., Esso Standard Oil Co., Box 5197, Baltimore 24, Md.

Morgan, Austin H., Jr., trainee, Highway Research Council, Thornton Hall, University of Virginia, Charlottesville, Va. For mail: Box 3817, University Station, Charlottesville, Va. [A]

Nitzberg, Daniel I., chemical engineer, Engineering Dept., Hoover Electronics, Co., 3640 Woodland Ave., Baltimore 15, Md.

Rivers, Thomas W., consulting engineer, 209 Evans St., Greenville, N. C.

Rogers, Percy L., vice-president, research, Riverton Lime and Stone Co., Riverton, Va.

Shope, John G., structural engineer, National Lumber Manufacturers Assn., 1319 18th St., N. W., Washington 6, D. C.

Thomas, James D., assistant manager, Bristol Concrete Products Corp., Box 617, Bristol, Va.

Thomason, W. A., Jr., president and treasurer, Thomason Textile Service, Inc., Box 8073, Charlotte 8, N. C.

U. S. Naval Proving Ground, Technical Library, Field Station, Bureau of Ordnance, Dahlgren, Va.

WESTERN NEW YORK-ONTARIO DISTRICT (10)

Clark, Robert, chief plant metallurgist, Atlas Steels, Ltd., Welland, Ont., Canada.

Cotsworth, R. P., sales engineer, National Slag, Ltd., Box 185 Station C., Hamilton, Ont., Canada.

Dashem, W. B. vice-president, Interlectric Corp., 1401 Lexington Ave., Warren, Pa.

Hall, David A., engineering dept., Bldg. 23, Eastman Kodak Co., Kodak Park, Rochester 9, N. Y.

Ontario Agricultural College, Department of Agricultural Engineering, Guelph, Ont., Canada.

Russell, P. N., manager, Dielectric and Magnetic Materials Electronics Lab., General Electric Co., Rm. 121, Bldg. 3, Electronics Park, Syracuse, N. Y.

Wellwood, F. E., commissioner, Department of Buildings, Corporation of the City of Toronto, 465 Bay St., Toronto 2, Ont., Canada.

U. S. AND POSSESSIONS

Citadel, The, Civil Engineering Dept., L. K. Himelright, head, Department of Civil Engineering, Charleston, S. C.

Coca-Cola Co., The, Lynn E. LaGarde, manager, Engineering Dept., 310 North Ave., N. W., Atlanta 13, Ga. For mail: P. O. Drawer 1734, Atlanta 1, Ga.

Pacific Welding Alloys (Philippines), Inc., Raul J. Akot, production manager, Box 795, Manila, Philippines

Raytheon Manufacturing Co., Missile Systems Div., George H. Longnecker, engineering services manager, Bristol, Tenn.

Sonoco Products Co., B. D. Clarkson, senior chemist, Chemical Dept., Hartsville, S. C.

Axtell, Willard G., chief engineer, Shwayder Brothers, Inc., 1050 S. Broadway, Denver 9, Colo.

Channing, Jules P., owner, Jules P. Channing Associates, 71 N. W. 54th St., Miami 37, Fla.

Garstka, Walter U., assistant chief, Chemical Engineering Laboratory Branch, Bureau of Reclamation, U. S. Department of the Interior, Bldg. 56, Denver Federal Center, Denver 2, Colo.

Karabedian, James A., chief chemist, Lily-Tulip Cup Corp., 1550 Wrightsboro Rd., Augusta, Ga.

Kennedy, R. Evan, chief engineer, Edmundson, Kochendoerfer & Kennedy, Architects and Engineers, 325 Henry Bldg., Portland 4, Ore.

Kingsley, Paul S., metallurgical engineer, Chemical Processing Dept., Facilities Engineering, General Electric Co., Hanford Atomic Products Operation, 271 T. Bldg., 200 West Area, Richland, Wash.

McMurry, C. J., southern district manager, Rome Cable Corp., 156 Simpson St., N. W., Atlanta 13, Ga.

Norrell, R. H., sales development representative, Eastman Chemical Products, Inc., Kingsport, Tenn.

Postlethwaite, R. C., office and field engineer, Portland Cement Assn., 721 Boston Bldg., Denver 2, Colo. For mail: 6260 Aberdeen Dr., Littleton, Colo.

Proud, Stanley L., engineer, Hedrick-Grove, A.P.O. 81, New York, N. Y.

Sinness, Norman S., laboratory supervisor, E. I. duPont de Nemours and Co., Inc., Textile Fibers Dept., Old Hickory, Tenn.

Smith, Edward A., senior engineer, General Electric Co., Richland, Wash. For mail: 1520 Butternut, Richland, Wash.

U. S. Dept. of the Navy, District Public Works Office, Thirteenth Naval District, Bldg. 232, Naval Station, Seattle 99, Wash.

U. S. Naval Station, Receiving Officer, Kodiak, Alaska.

Vann, Robert W., engineer, Chicago Bridge and Iron Co., Birmingham, Ala. [A]

(*Continued on page 103*)

New Members

(Continued from page 101)

OTHER THAN U. S. POSSESSIONS

Avesta S. A. (Pty.), Ltd., P. Christie, laboratory technician, 43 Resnick St., Factoria, Krusersdorp, Transvaal, South Africa.

Hawaiian Electric Co., Ltd., The, Frank R. Montgomery, principal mechanical engineer, Box 2750, Honolulu 3, Hawaii.

Industrias Kaiser Argentina, S. A., D. Gowland, administrative engineer, Paseo Colon 439, Buenos Aires, Argentina.

International Surveyor Co., Ltd., Y. C. Lee, president, Rm. 205, 138, Pao-ai Rd., Taipei, Taiwan

Technical Organisation of Petroleum Inspectors, F. Cardia, director, Via XX settembre, 34–8, Genoa, Italy

Baghdad, College of Engineering, Baghdad, Iraq.

Bisbe, Jose Manuel, teaching assistant, Rensselaer Polytechnic Inst., Troy, N. Y. For mail: 26 #4510 Alturas de Miramar, Marianao, Havana, Cuba. [A]

Burma, Union of, Applied Research Inst., Director-General, Junction of Kaba Aye, Pagoda and Kanbe Rds., Rangoon, Burma.

Byers, Albert Douglas, manager, Technical Dept., Atlas Asbestos Co., Ltd., 5600 Hochelaga St., Montreal P. Q., Canada. For mail: Box 878, Place d'Armes, Montreal, P. Q., Canada.

Elías Muñiz, Rafael, materials laboratory engineer, Tippetts - Abbett - McCarthy-Stratton, Box 10334, Caparra Heights, Puerto Rico. For mail: 401 Andalucía St., Puerto Nuevo, Puerto Rico. [A]

Garcia Sainz, Ricardo, assistant manager, Conductores Electricos, S. A. Poniente 140 y Norte 59, Col. Ind. Vallejo, Mex.

Haite, Heinz, engineer, Verin Deutscher Eisenhuttenleute, Dusseldorf, Germany. For mail: Pose-Narre, Edelstahlwerk GmbH, Gerberstr. 26, 21, Erkrath, Rhl, Germany.

Kolozs, John E. P., technical director, Electrovert, Ltd., 265 Craig St., W., Montreal, P. Q., Canada. For mail: 3220 Ridgwood Ave., Montreal, P. Q., Canada.

Lewis, E. N., director, Ratcliffs (Great Bridge), Ltd., Great Bridge, Tipton, Staffs., England.

Meyer, Erik V., civil engineer, Technical Information Office of Danish Cement Works, Christians Brygge 28, Copenhagen V, Denmark.

Milano, M. Joseph, chief of specifications, Litchfield, Whiting, Panero, Severud and Associates, Via Quattro Fontane 15, Rome, Italy.

Mintzer, Olin W., professor of highway engineering, Punjab Engineering College, Chandigark, India. For mail: APO 74, Box N, San Francisco, Calif.

Moraschinelli, Enos, S.A.C.E.M., 54 Via Zuretti, Milan, Italy.

Oliveros, Fernando, ingeniero decaminos, Colegio de Ingenieros de Caminos, Alfonso XII, 3, Madrid, Spain. For mail: Ayala 67, Madrid, Spain.

Recasens, Isidoro, chief engineer, Inspection of "Orinoco" Steel Plant, Presidencia de la Republica, Oficina Estudios Especiales, Miraflores, Caracas, Venezuela. [A]

DEATHS...

R. L. Albrook, director, Division of Industrial Research, Washington State Institute of Technology, Pullman, Wash. (May 14, 1957). Representative of Institute membership since 1952, and member of Committee C-12 on Concrete Pipe, and its Subcommittee III on Irrigation and Drain Pipe.

G. H. Anderson, engineer of structures, New England Power Service Co., Boston, Mass. Representative of company membership since 1956, and member of New England District Council.

Parker K. Baird, in charge of processing, paper making and paper testing section, U. S. Forest Products Lab., Madison, Wis. (April 29, 1957). Representative of Laboratory on Committee D-6 on Paper and Paper Products since 1941.

I. C. Clare, Research Dept., C. K. Williams & Co., Easton, Pa. (January 13, 1957). Representative of company since 1949 on Committee D-1 on Paint, Varnish, Lacquer, and Related Products, and several subcommittees; also represented Hercules Powder Co. for a number of years on Committee D-1, and on Committee D-14 on Adhesives. Represented Committee D-1 on Committee E-1 on Methods of Testing from 1946 to 1956.

E. L. Cook, mechanical engineer, Seaboard Air Line Railroad Co., Norfolk, Va. (Aug. 8, 1956). Representative of company membership since 1941.

R. W. Craig, chemist, Diamond Alkali Co., Painesville, Ohio (September 29, 1956). Member since 1944.

(Continued on page 104)

Deaths

(*Continued from page 103*)

Beverley A. Evans, supervising engineer, du Pont Company of Canada, Ltd., Montreal (May, 1957). Member since 1955.

C. A. Gutenkunst, Jr., president, Milwaukee Malleable and Grey Iron Works, Milwaukee, Wis. Representative of company membership since 1947, serving on Committee A-7 on Malleable-Iron Castings.

Ralph V. Hilkert, chief, physical metallurgy div., research laboratory, Titanium Alloy Manufacturing Div., National Lead Co., Niagara Falls, N. Y. (April 15, 1957). Representative of Division since 1955 on Committees A-3 on Cast Iron, A-9 on Ferro-Alloys, and A-10 on Iron-Chromium, Iron-Chromium-Nickel and Related Alloys.

Carlton G. Lutts, retired head of the Boston Naval Shipyard Materials Laboratory, died suddenly on April 17, 1957 while on a vacation trip to Florida. With the shipyard from 1917 until his retirement April 30, 1956, Mr. Lutts was recognized throughout the Navy as an authority on the development and manufacture of chain and rope. He was the first president of the Society for Nondestructive Testing when it was founded in the Boston Shipyard in 1942. In 1953 he was presented with a Meritorious Civilian Service Award, pointing out his accomplishments from the time he was coinventor with the late master mechanic Albert M. Leahy of the Forge and Chain Shop (at the Boston Shipyard) of the famous Die-Lock Chain; and further citing his notable achievements in the application of a million-volt X-ray machine to take pictures of the internal parts of metal castings and the initiation of the use of a small portable X-ray machine to inspect welding on ships. Affiliated with many technical and professional organizations, Mr. Lutts had been a loyal member of ASTM since 1918. He had been especially active in the work of the New England District Council, being a charter member of this group. Zealous in all his interests, and loved and respected by friends and associates, "Carl" will be greatly missed. He is survived by his wife, Mrs. Grace A. Smith Lutts, Cabot Farm, Salem, Mass.; two sons, Richard W. of Blue Point, N. Y. and Carlton, Jr. of Salem, and a daughter, Mrs. Francis C. Burnham of Salem.

Frank Hynes Reed, chief chemist, Illinois State Geological Survey Division, Urbana (April 27, 1957). Active in many technical organizations, Dr. Reed had been a member of ASTM Committee D-5 on Coal and Coke since 1940, serving on Subcommittee XVIII on Classification of Coals. Following World War II Dr. Reed served several Government agencies relating to the use of coal, and was sent on missions to Germany and to Japan to study coking processes.

Harold Rosenbloom, director of research Thompson & Co., Oakmont, Pa. (April 19, 1957). Representative of company membership since 1955. Affiliated with Thompson & Co. for the past ten years, Mr. Rosenbloom was considered an authority on vinyl coatings, wash primers, and kindred compounds.

William J. Schlick, research professor, Engineering Experiment Station, Iowa State College, Ames (February 5, 1957). A member of Iowa State faculty for 43 years, Professor Schlick was active in research, teaching, and administration, pioneering in the field of hydrology and drainage engineering. He had many publications in the field of drainage, underground conduits, and pipe loads. Active in many professional and scientific societies, his affiliation with ASTM dated from 1920. Through the years he had contributed to the deliberations of a number of the technical committees of the Society, including former Committee C-6 on Drain Tile, Committees A-3 on Cast Iron, C-13 on Concrete Pipe, C-15 on Manufactured Masonry Units, and D-18 on Soils for Engineering Purposes.

W. J. D. van Dobbenburgh, American Enka Corp., Enka, N. C. (May, 1957). Representative of his company since 1945 on Committee D-13 on Textile Materials, and active in many of the subgroups and sections, serving in advisory groups, and specifically at the time of death as secretary of Subcommittee B-8 on Yarn Test Methods, General.

NEWS NOTES ON

Laboratory Supplies and Testing Equipment

Note—This information is based on literature and statements from apparatus manufacturers and laboratory supply houses. The society is not responsible for statements advanced in this publication.

LABORATORY ITEMS

Tanks—A new line of standard size, polyethylene laboratory tanks ¼ in. thick, and measuring 9 by 9 by 9 in. is available.
American Agile Corp. 1364

Potentiometer—The Alinco Model P-55 is a small, lightweight potentiometer and millivolt source in one instrument.
Allegany Instrument Co., Inc. 1365

Measuring Internal Diameters—A new internal measuring instrument featuring an optical vernier has been introduced.
American Gauge Corp. 1366

Rubber Test Grinders—A laboratory grinding machine for preparing test specimens from rubber and other flexible products is available. The grinder consists of a heavy duty, double end, motor-driven grinder with two grinding wheels operating on 115-v, 60-cycle, single phase current at 3450 rpm.
American Instrument Co., Inc. 1367

Environmental Salt Spray—A new, all-Lucite salt-spray chamber for determining salt fog corrosion resistance of materials and components.
Associated Testing Labs. 1368

Paper Electrophoresis—Design advancements intended to make paper-strip electrophoresis procedures faster and more reproducible are incorporated in the new Spinco Model R Paper Electrophoresis System.
Beckman Instruments, Inc. 1369

Delay Generator—A new precision delay generator, type 6010, designed for laboratory type applications where accurate, variable, time interval pulses are required.
Burroughs Corp. 1370

Chromatograph—A new vapor-phase analyser for gas chromatography. The analyser comes complete with one 10-ft coiled column, packed with tricresyl phosphate. Other packed columns are available on special order.
Central Scientific Corp. 1371

Mass Spectrometer—A precision instrument developed to provide an accurate but inexpensive, small-size model for medical, industrial, and university applications.
Consolidated Electrodynamics Corp. 1372

Ionization Gage—New ionization vacuum gage which gives continuous pressure readings on eight linear ranges from 1×10^{-3} to 2×10^{-12} mm Hg.
Consolidated Electrodynamics Corp. 1373

Position Indicating System—Remote electrical indication of position, size, tension, strain, thickness, and other quantities which can be related to minute displacement of a feeler probe, is accomplished using the Model 100 displacement transmitter with the new Model 300 displacement indicator.
Daytronic Corp. 1374

4-Channel Recording Oscilloscope—A versatile, highly sensitive 4-channel recording oscilloscope, *Bulletin H-42B*.
Electronic Tube Corp. 1375

(*Continued on page 106*)

Test Bridge for Plastics—A test bridge designed specifically for measuring dielectric properties of sheet plastics and for analysis of the electrical performance of oils and other liquids.
Federal Telephone & Radio Co. 1376

Accurate UHF Millivoltmeter—Ideal for calibrating signal generators, for determining signal levels, and for measuring minute voltage levels.
Federal Telephone & Radio Co. 1377

Electro-Analyzer—The electro-analyzer is designed so that the current can be controlled manually throughout the analysis. The precise positioning and careful manufacture of its electrodes assure that the current density can also be controlled.
Fisher Scientific Co. 1378

Chromatograph Scanner—Model F windowless scanner is designed for the scanning of two-dimensional paper chromatograms tagged with low energy beta-emitting isotopes.
Ferro Scientific Co. 1379

Air Gage—A new comparator gage that works on the back-pressure circuit principle was introduced recently.
Freeland Gauge Co. 1380

Optical Measuring Instruments—A new concept in measuring instruments called coordinate cathetometers, make both a horizontal and vertical measurement in a vertical plane at one setting.
Gaertner Scientific Corp. 1381

Capacitance Bridge—The type 716-CS1 capacitance bridge has been designed specifically for one-megacycle capacitance measurements, and is now offered in a complete assembly, type 1610-AK, including generator and detector.
General Radio Co. 1382

New Variacs—The W50, largest unit in the variac line, replaces the older type 50 and is available in a complete series including 115 and 230-v models, cased and uncased units, and ganged assemblies.
General Radio Co. 1383

Crystal Goniometer—A new, high-precision quartz crystal X-ray goniometer permitting operators to orientate crystal surface and lattice planes quickly to accuracy within 30 sec of arc, is available in the U. S.
Jarrell-Ash Co. 1384

Direct-Reading Spectrographs—This instrument will analyze complex alloys of 29 elements or less in approximately four min., automatically printing the results on a slip of paper.
Jarrell-Ash Co. 1385

Micro-Microammeter—The ultra-stable Model 411 micro-microammeter provides high resolution for a broad range of measurements from 10^{-1} to 10^{-11} amp.
Keithley Instruments, Inc. 1386

Transistorized Electrometer—The dual-purpose Model 220 dc VTVM couples a verstile d-c amplifier with a sensitive electrometer of broad range. It has eight ranges from 30 mv to 100 volts full scale and provides gains of 0.05 to 167.
Keithley Instruments, Inc. 1387

Test Cabinette—A universal cabinet suitable for temperatures from 300 F to −120 F can be arranged for altitude testing and also variable humidity control.
Labline, Inc. 1388

Photometer—A photoelectric instrument designed to detect light changes in the micro-lumen range is in production. The operating sensitivity of the unit is adjustable within a wide range of light change limits to meet specific requirements.
Lindly & Co. 1389

Recording Systems—Precision analog recording system has been designed and engineered to provide an accurate method of obtaining an oscillographic presentation of data which have been recorded on magnetic tape.
Midwestern Instruments 1390

Moisture Detector—Combination of Laucks' Sentry and Brown's Electronik Recorder records wood and hardboard moisture content.
Minneapolis-Honeywell 1391

Phase Angle Voltmeter—A novel VT-VM having a phase-sensitive rectifier which can measure both magnitude and phase of a signal as well as perform other valuable electronic test functions has been developed.
North Atlantic Industries, Inc. 1392

Counters—High sensitivity and large well sizes (from $^5/_8$ in. diam by $1^1/_2$ in. deep to $6^3/_4$ in. diam by 12 in. deep) result in up to thousandfold increases in counting efficiency with no time lost for aliquots and calculations.
Nucleonic Corporation of America 1393

Fluid Dispenser—Universal semiautomatic fluid dispenser eliminates losses, contamination, unwieldiness, and guesswork of bottle-pouring. Ideal for frequent dispensing of small amounts of fluids for routine laboratory.
Palo Laboratory Supplies, Inc. 1394

Panoramic Panalyzor—Designed for applications requiring extremely high resolution, such as investigations of side bands caused by low modulating frequencies, single side band transmissions, teletype, etc., the SB-12 can be used to observe signals anywhere in the spectrum up to 1000 mc.
Panoramic Radio Products, Inc. 1395

Sub-Sonic Analyzer—Featuring resolution of 0.5 cps over the full frequency range from 0.5 cps to 2250 cps (0.1 cps up to 225 cps) and six different sweepwidths which may be centered at almost any point, the LF-2 Subsonic Analyzer is a versatile tool for waveform analysis.
Panoramic Radio Products, Inc. 1396

Hydraulic Press—New Hart hydraulic press is designed for calibrating dynamometers and similar compression tests where it is necessary to measure accurately forces up to 30,000 kg (approx. 66,000 lb). When desired, accessories are supplied in order to handle tensile forces.
Philips Electronics, Inc. 1397

Ultra-Buret—Micro markings to 0.001 ml can be read to 0.0001, up to 7 ml without refilling. Reservoir capacity 50 ml.
Scientific Industries, Inc. 1398

Torque Calibrator—A new hydraulic torque wrench calibrator, capable of testing torque wrenches to within 1 per cent of accuracy of full-scale reading.
Skidmore-Wilhelm Mfg. Co. 1399

Control of Test Limits—New, compact, precision-made device, called the Programmer Counter, that is used to turn on and off test apparatus whose limits are sensed by strain gages, thermocouples, or any other transducers that have a maximum output not exceeding 100 mv dc has been developed.
Spar Engineering and Development, Inc. 1400

Voltage Regulator—Stabiline automatic voltage regulator type TMH7101 is designed for 400 cycle, single-phase applications where requirements demand small, lightweight equipment. It has no tubes, transistors, or moving parts.
Superior Electric Co. 1401

Impact Tester—The machine makes the Izod (cantilever beam) or Charpy (simple beam) test on each of three capacity ranges. Separate hammer for each test in each capacity range (6 hammers in all). Hammers are interchangeable.
Testing Machines, Inc. 1402

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Thermowells—A new, expanded line of thermowells, both bar stock and built-up types, is being offered.
Thermo Electric Co., Inc. 1403

Impact Tester—A new impact tester for plastics, paper, rubber, boxboard, and similar materials.
United States Testing Co., Inc. 1404

CATALOGS and LITERATURE

Friction Tester—*Bulletin 106*, revised to incorporate new operating information on the Model LFW-1 lubricant friction-wear testing machine, has been released.
Alpha Molykote Corp. 2249

Direct-Current Hypots—Three new mobile type d-c hypots for high-potential testing of high-voltage cables, insulation materials, and related high-voltage equipment are described in *Bulletin 5-1.1*.
Associated Research, Inc. 2250

pH Electrodes—Eight-page bulletin, *#86-5*, features pH electrodes for laboratory and portable pH meters.
Beckman Instruments, Inc. 2251

Metallurgical Samples—*Metal Digest* Vol. III, No. 2 describes metallurgical samples and measurement of plated sections.
Buehler, Ltd. 2252

Laboratory Power Supplies—A new brochure illustrating and describing three power supplies in the laboratory instrument line has been published.
Burroughs Corp. 2253

Pressure Gage—A secondary pressure standard, electromanometer is described in a 4-page folder, *Bulletin 1547A*.
Consolidated Electrodynamics Corp. 2254

Test Equipment—A 20-page mill and plant equipment *Bulletin No. G3-B59*, showing equipment such as dryers, thickeners, mineral jigs, testing, sieve shakers, and automatic samplers has been released.
Denver Equipment Co. 2255

Optical Aids—More than 1000 optical items listed, hundreds of illustrations, technical data, and other factual information on all types of optical instruments and components, are included in the 72-page catalog.
Edmund Scientific Co. 2256

Organic Chemicals—A revised catalog of fine organic reagents is available.
Fine Organics, Inc. 2257

Polyethylene Ware—Latest developments in polyethylene ware for laboratories is described in the 8-page bulletin, *No. FS-268*.
Fisher Scientific Co. 2258

Spectrographs—An informative new 24-page brochure describes the design and applications of a variety of excitation source units and discharge stands used in spectrochemical analysis.
Jarrell-Ash Co. 2259

Corrosion Tester—New 16-page brochure on "Corro-Dex" for determining rates of corrosion is available in two models: line-operated, and portable battery-operated.
Labline, Inc. 2260

Drying—New freeze-drying laboratory equipment is the subject of a 4-page brochure recently published. Brochure describes new completely automatic freeze-drying equipment, new types of tray dryers, and manifold-type freeze-dryers.
Arthur S. LaPine & Co. 2261

Electrolytic Conductivity—New two-page *Data Sheet E-95(2)* describing the Jones conductivity bridge for precise electrolytic conductivity measurements.
Leeds & Northrup Co. 2262

Methane Detector—A new bulletin, *Bulletin No. 0809-4*, is offered describing the portable MSA Type W-8 methane detector, which can quickly and accurately determine the methane content of air.
Mine Safety Appliances Co. 2263

Electronic Test Equipment—A new 48-page edition of Microwave and UHF electronic test equipment, covers complete line of waveguide test equipment, bolometers, and thermistors.
Narda Corp. 2264

Testing Hardness—A new, four-page folder illustrating and describing the many features of an accurate, portable, 30-oz instrument which can be used in any position

to test the hardness of any size, shape or type metal.
Newage Industries, Inc. 2265

Survey Meters—A line of four laboratory survey meters for detecting radioactivity are described in new *Bulletin GS-57*.
Nuclear Measurements Corp. 2266

Vacuum Gages—A four-page, two-color catalog, *Bulletin D-2*, on accurate, sensitive mercurial barometers and vacuum gages, vacuum pump gages, and absolute pressure gages has been issued.
Precision Thermometer & Instrument Co. 2267

Instrumentation Tape—A new booklet describing Soundcraft Type B instrumentation tape designed specifically for telemetering.
Reeves Soundcraft Corp. 2268

Apparatus Catalog—New 32-page catalog describes laboratory apparatus.
E. H. Sargent & Co. 2269

Lab. Grinder—Four-page brochure describes automatic laboratory sample grinder.
Spex Industries, Inc. 2270

Electron Tubes—Technical handbook contains data including operating specifications and characteristic curves for electron tubes.
State Labs., Inc. 2271

Ductility Tester—Literature (*Form D-856*) gives complete information and specifications of Model D ductility tester with excellent photographs.
Steel City Testing Machines, Inc. 2272

Torque Tester—Four-page folder describes and illustrates uses of torque tester.
P. A. Sturtevant Co. 2273

Variable Transformers—An illustrated 28-page bulletin, *Bulletin P257H*, offers features, ratings, and complete data on a new standard line of Powerstat variable transformers for high-frequency applications.
Superior Electric Co. 2274

Testers—Leaflets describe ply-adhesion tester useful for ASTM D 825-54 method A, and an impact-fatigue tester.
Thwing-Albert Instrument Co. 2275

Chart for Hardness Values—A new desk-size chart containing conversion data for Rockwell tests and other hardness scales is available.
Torsion Balance Co. 2276

INSTRUMENT COMPANY NEWS

Atlas Electric Devices Co., Chicago 13, Ill.—Announced the appointment of Matthew J. Babey, as their sales and technical service representative for the New York City greater metropolitan area. He replaced Fred Schlayer, who retired after having represented Atlas in that area for over 35 years.

Brush Electronics Co., Cleveland, Ohio—Manufacturers of industrial and research instruments, has established a factory branch office in Los Angeles.

Burroughs Corp., Pasadena, Calif.—ElectroData Div. has completed a sixfold enlargement of its Pasadena plant, now totaling 250,000 sq ft. The $4-million plant is the West's largest engineering and production facility for electronic computers.

Harris Refrigeration Co., Cincinnati 18, Ohio—Appointment of Rolland S. Jamison to supervise a national marketing and publicity program for Harris low-temperature refrigeration equipment has been announced. He will administer this program from his headquarters in Cincinnati, Ohio in addition to supervising application engineering in 14 states in the Midwest area.

Monroe Microscope Service, Rochester, N. Y.—Monroe Microscope Service has become an authorized Leitz Instruments dealer. In addition a repair and custom-built optical shop has been opened.

Tinius Olsen Testing Machine Co., Willow Grove, Pa.—Appointment of the Ellison Co. as southern representatives for physical soil testing and static-dynamic balancing machine sales has been announced.

Philips Electronics, Inc., Mount Vernon, N. Y.—J. D. Rodgers has been assigned to San Francisco as sales and service engineer on Norelco electron optical instruments and John Mead has been assigned to Chicago as service engineer.

LABORATORY NEWS

American Electronics, Inc., Los Angeles, Calif.—Ground-breaking ceremonies for American Labs., a new division of American Electronics, Inc., were recently held in Fullerton, Calif. The environmental test laboratory, scheduled for completion by August of this year, is being established to meet the increasing demand for facilities to test electrical, electromechanical and electronic packages up to 10 cu ft in size.

OTHER SOCIETIES' EVENTS

July 29–August 2—**World Conference on Prestressed Concrete,** Univ. of Calif. and Prestressed Concrete Institute, Fairmont Hotel, San Francisco, Calif.

August 6–10—**Institute of Aeronautical Sciences,** Naval Aviation Meeting, U. S. Grant Hotel, San Diego, Calif.

August 12–15—**ASME, AIChE,** 1st National Conference on Heat Transfer, Penn State Univ., University Park, Pa.

August 12–15—**Society of Automotive Engineers, Inc.,** National West Coast Meeting, Olympic Hotel, Seattle, Wash.

August 12–24—**International Society of Soil Mechanics and Foundation Engineering,** 4th Conference, London, England.

August 23–September 4—**International Radio Scientific Union,** 12th General Assembly, Boulder, Colo.

August 26–27—**American Mathematical Society,** Summer Meeting, Penn State University, University Park, Pa.

August 28–30—**AIEE,** Pacific General Meeting, Yakima, Wash.

September 4–6—**Fiber Society,** Joint meeting with **British Textile Institute,** Hotel Statler, Boston, Mass.

September 5–6—**American Ceramic Society,** Annual Meeting of Structural Clay Products Div., Clemson House, Clemson, S. C.

September 5–7—**Electron Microscope Society of America,** MIT ,Cambridge, Mass.

September 8–13—**American Chemical Society,** 132nd National Meeting, New York, N. Y.

September 9–10—**American Ceramic Society,** Annual Meeting of Basic Science Div., Alfred Univ., Alfred, N. Y.

September 9–13—**Instrument Society of America,** 12th Instrument-Automation Conference and Exhibit, Auditorium, Cleveland, Ohio

September 9–13—**Illuminating Engineering Society,** Annual Meeting, Biltmore, Atlanta, Ga.

September 11–13—**National Petroleum Assn.,** 55th Annual Meeting, Traymore Hotel, Atlantic City, N. J.

September 14–20—**American Society for Metals,** National Metal Congress, Palmer House, Chicago, Ill.

September 15–18—**American Institute of Chemical Engineers,** Regional Meeting, Lord Baltimore Hotel, Baltimore, Md.

September 15–20—**International Union of Leather Chemists Societies,** 5th Biennial Conference, Rome, Italy.

September 16–19—**International Municipal Signal Assn.,** 62nd Annual Meeting, Fontainebleau Hotel, Miami Beach, Fla.

September 22–25—**ASME,** Petroleum Conference, Mayo Hotel, Tulsa, Okla.

September 23–24—**Steel Founders' Society of America,** Fall Meeting, The Homestead, Hot Springs, Va.

September 23–25—**ASME,** Fall Meeting, Statler Hotel, Hartford, Conn.

September 23–25—**Standards Engineers Society,** 6th Annual Convention, Commodore Hotel, New York, N. Y.

September 23–26—**Association of Iron and Steel Engineers,** Annual Convention, Penn Sheraton Hotel, Pittsburgh, Pa.

September 24–25—**IRE and AIEE,** Industrial Electronics Conference, Morrison Hotel, Chicago, Ill.

September 26–28—**American Ceramic Society,** Annual Meeting of White Wares Div., and Materials Equipment Div., Bedford Springs Hotel, Bedford, Pa.

September 29–October 8—**International Society of Soil Science,** 6th International Congress, Paris, France.

The Bookshelf

(Continued from page 52)

Guide for Ultimate Strength Design of Reinforced Concrete

American Concrete Institute, Detroit, Mich.; 75 cents.

There are 15 design charts included for which enlargements approximately 12 in. square are available in covers in sets at $2 each.

THE ULTIMATE strength method for the design of reinforced-concrete members is permitted in the latest issue of the ACI Building Code, published by the American Concrete Inst., which bears the designation of ACI 318-56. A report prepared by C. S. Whitney and Edward Cohen entitled, "Guide for Ultimate Strength Design of Reinforced Concrete," serves as a supplement to the ACI Building Code and presents a method in its simplest form with working equations and charts to aid in their application. It aims to give the designing engineer all the information that he needs for the ultimate strength method in accordance with the recommendations of the report of the ACI-ASCE joint committee on ultimate strength design.

Engineering and Design Manual

Investment Casting Inst., 27 E. Monroe St., Chicago, Ill.; 50 pp.; $5.

THIS MANUAL contains the most complete and authoritative information on the investment casting process ever presented. The culmination of more than $2^1/_2$ years of combined efforts on the part of various institute committees, it has been designed to aid industry to understand more clearly the advantages and limitations of the investment casting process.

Of particular importance is the manual's design section which presents rules governing design, dimensional tolerances, and shapes. Other subject matter covered in this section includes surface finish, functional and general tolerances, radii, straightness, flatness, concentricity, roundness, angles, length, parallel sections, blind and through-going cores, threads, airfoil, contours, and others.

The publication details both the lost pattern and frozen mercury phases of the process, and features ten pages of case histories covering investment cast parts. Still another section is devoted to the Institute's metal specifications and test bar standards.

The manual contains more than 70 illustrations including several dozen engineering drawings which supplement the design information text.

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One sentence descriptions of new testing machines, laboratory or control apparatus, and related equipment.

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